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Designed to fill the need for a single source document containing information about the technical education field, this yearbook was compiled for those people now offering technician training, for those planning to offer it in the near future, and for guidance personnel so that they may intelligently counsel young people who are planning careers as technicians. A nationwide directory of schools offering technician training presents the schools, by state, and lists the total and technician enrollment, the admission requirements, and the available programs for each. Other sections present (1) occupational information about the technician including the nature of work, areas of employment, training, placement, salaries, advancement, and employment outlooks and projections, (2) case studies for selected programs in schools located in Connecticut, Georgia, Illinois, Michigan, New York, North Carolina, Oregon, and Wisconsin, and (3) information on federal laws and regulations concerning technician education, the professional organizations concerned with technician education, certification of engineering technicians, and a future trends forecast. A bibliography contains (1) books, (2) federal, state, and local governmen publications, (3) educational institution publications, (4) articles, (5) periodicals, and (6) other pamphlets containing information on technician education. (HC)

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Technician
Education
Yearbook

1963-1964

Prakken Publications, Inc.
Ann Arbor, Michigan

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Foreword

EDUCATORS, concerned about the fact that they have had to search—often fruitlessly—for information they wanted about technician training, have literally asked that this Yearbook be published. With the recent, rapid growth in technician training and the increased public awareness of the importance of such training, the need for a single source book containing information about this field has become vital. This Yearbook is designed to fill that need. We have tried to include in this volume the information those in the field indicated would be of most help to them.

One of the obvious difficulties in preparing this volume was the matter of definition of terms. In other words, who and what is a technician? Carl Schaefer and Robert E. McCord highlight this problem in the first section of this book. In their discussion, they offer some definitions of their own. Unanimity in the matter of definition, however, is still to be realized.

Nevertheless, we do wish to point out that we have limited the concept of "technician" in this volume to the industrial-technician field; namely, to those trained technical workers who assist engineers and scientists and do other technical work in industry. This excludes technicians in such fields as medicine, dentistry, etc.

Another problem in the preparation of this book was the compilation of the first nationwide directory of schools offering technician training. We feel, however, the value of this directory to those in the field will be well worth the time and effort expended. Although it is difficult to be positive that any compilation, and particularly the first one, is complete and accurate, we believe that the list is as accurate as is humanly possible at this time. For help in making it so, we wish to thank the staff members of the U.S. Office of Education Technical Education Branch and the state departments of education throughout the country, as well as leaders in the field. Questionnaires were sent to nearly 1,000 schools that were said to offer technician training, and the information for the listing was obtained largely from the replies to these questionnaires, augmented by information from the sources mentioned above.

We present this first TECHNICIAN EDUCATION YEARBOOK, 1963-64, with a great deal of pride for what it contains: the first nationwide directory of schools offering technician training, the federal laws and regulations concerning technician education, case studies of some of the excellent programs now in operation, statistical information about the field now, and a forecast of the future of technician training.

Our purpose in publishing this compendium of information will be accomplished if it proves helpful to those people now offering technician training, to those planning to offer it in the near future, and to guidance personnel so they can intelligently counsel young men and women who are planning careers as technicians.

—*The Editors*

Acknowledgments

To give credit for the help given in preparing a new book for publication always poses a problem; there are so many persons involved, it is next to impossible to list and thank them all. So, first of all, let this be a blanket acknowledgment of thanks to all who cooperated with us in getting the information for this book.

Special recognition, however, should be given to the following persons and organizations for their cooperation, their help, and their encouragement:

Maurice W. Roney, former chief of the U.S. Office of Education Technical Education Branch, now director of the school of industrial education, Oklahoma State University, Stillwater.

Staff members of the U.S. Office of Education Technical Education Branch, Washington, D. C.

Staff members of the U. S. Department of Labor, Bureau of Labor Statistics, Washington, D. C.

Officials of the various state departments of education.

The various professional organizations in the field, and particularly the American Association of Junior Colleges and the American Council on Education.

The many individuals, institutions, and companies serving the field of industrial education.

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Section 1

The Problem of Definition

The Technician: Some Definitions

By Carl J. Schaefer

**Professor of Industrial Education,
Rutgers University, New Brunswick, New Jersey**

and Robert E. McCord

**Director, Continuing Education in Engineering,
The Pennsylvania State University**

THE man of the hour, the technician, continues to elude and spread havoc in the circles of those who profess to define him. State and national meetings glibly discuss the all-important individual and his role in modern technology only to have confusion of definition run rampant through the audiences. Educators, it seems, almost delight in their diversity of opinion on the subject and much time and effort has been lost in "taking sides" at state and national levels. Great concern has been voiced over the wording of federal legislation, jurisdictional implications, and the adequacy or inadequacy of certain facets of the educational profession to carry out programs of technical education. Meanwhile, the urgent need to educate more technicians, however they may be defined, continues at an alarming rate.

The problem would be quite simple if industry itself would come forth with a common definition to describe the technician. Unfortunately, this is not the case and industry appears to be only too willing to acquire, at almost a devouring rate, any individual who professes to have completed any technical educational program.

Inability to define the word "technician" is reflected in the failure of various national committees and interested organizations to agree on an all-inclusive definition. A Special Committee on Technical Institute Legislation of the National Society of Professional Engineers (1962) has but recently attempted to clarify the term in a paper relative to the education of the engineering and scientific technician. Wide circulation of this document should assist in clarification at this level. Dr. Lynn A. Emerson (1962) further attempts to clarify the term in his report to the Panel of Consultants on Vocational Education. Here, too, is a document worthy of intensive reading.

It is evident that "technician" is a generic term encompassing many and varied levels and types of technicians. Therefore, to buffet the term around promiscuously is but to further compound the confusion that already exists. The solution then is to come to grips with the term itself. Some educators have suggested two types of technicians be referred to as: the *engineering* and the *industrial* technician.

In 1953 the Engineers' Council for Professional Development defined an engineering technician as:

> . . . . one who can carry out in a reasonable manner either proven techniques which are common knowledge among those who are technically expert in this branch of engineering, or those specially prescribed by professional engineers.

> Under general professional engineering direction, or following established engineering techniques, he shall be capable of carrying out duties which may comprise: working on design and development of engineering plant; draftsmanship; the erecting and commissioning of engineering equipment or structures; estimating inspection and testing engineering equipment; use of surveying instruments; maintaining engineering machinery or engineering services and locating faults; operating, maintaining, and repairing engineering plant; or activities connected with research and development, sales engineering and representation, servicing and testing of materials and components, advising consumers; and training and education.
>
> In carrying out many of these duties, the competent supervision of the work of skilled craftsmen will be necessary. The techniques employed demand acquired experience and knowledge of a particular branch of engineering, combined with the ability to work out the details of a job in the light of a well-established practice.
>
> An engineering technician, therefore, requires a background sufficient to enable him to understand the reasons and purposes of the operation for which he is responsible. (ECPD *Twenty-First Annual Report*, 1953, p. 17.)

Relative to the industrial technician, no clear-cut definition has been formulated. The distinction which is suggested throughout this article, however, can be read into many reputable definitions. For example, the Office of Education has developed the following broad description of the technician:

> A general term applied to an individual who assists with technical details in a trade or profession. Uses tools, instruments, and/or special devices to design, illustrate, fabricate, maintain, operate, and test objects, materials, or equipment. Performs mathematical and scientific operations reporting on and/or carrying out a prescribed action in relation to them. Examines and evaluates plans, designs, and data; determines action to be taken on the basis of analysis; assists in determining or interpreting work procedures and maintaining harmonious relations among groups of workers.

As these definitions suggest, the technician may work under a wide variety of payroll titles, most of which do not include the word "technician." It is also apparent that a sharp line cannot always be drawn to differentiate between semiprofessional activities, such as computation, analysis, or laboratory testing, and those that border on skilled labor, such as installation or troubleshooting of mechanical, electrical, or electronic equipment. The degree of technical ability required by these jobs varies considerably.

Engineering technicians, whose jobs have relatively wide scope and call for a high level of mathematical, scientific, and applied technical ability, are sometimes considered to be "semiprofessionals." They are usually oriented toward one of the major fields or branches of engineering (mechanical, electrical, chemical, aeronautical, construction, electronics, etc.) They need a broad postsecondary education with emphasis on applied technology, which will prepare them to assist engineers, scientists, or other professionals in their field. They may generally be distinguished as being "field oriented."

The industrial technician operates within a narrower range of activities and is usually "job oriented." His work centers on specific jobs: inspection, quality control, troubleshooting, and the like. He needs less mathematics and science than the engineering technician, and more limited training in technology. On the other hand, he usually needs more training and development in manipulative skills.

As noted, however, it is not always easy to distinguish technical occupations from skilled craft occupations in industry. A rough measure that is sometimes used is to call the job "technical" if the worker spends more than half of his time on tasks that are mental rather than manipulative. (Emerson, 1958.)

Field-Oriented versus Job-Oriented Training

The field-oriented engineering technician requires preparation encompassing considerable scope and depth. A few of the more familiar programs he may choose are outlined in the following paragraphs.

Chemical Technology. A program designed to provide theoretical and practical training for men and women who wish to prepare for technical production and supervisory positions in the chemical field.

Electrical Technology. A program designed to prepare graduates for technological service with electrical utilities, manufacturers of electrical and electronic equipment, and electrical maintenance and instrument departments of various industrial concerns.

Industrial Technology. A program designed to provide basic training in application of inspection, time and motion study, production planning, materials handling, plant layout, statistical quality control, and cost control as found in modern manufacturing enterprises.

Mechanical Technology. A program designed to provide basic training in the application of fundamental principles of machine design, tool design, production planning, heat and power equipment, air-conditioning and refrigeration equipment, materials testing, and industrial instruments.

Metallurgical Technology. A program designed to prepare graduates for work as assistants to metallurgists and production supervisors of metal plants.

Construction Technology. A program designed to develop a sound conception of the related problems of the owner, the architect, the engineer, the manufacturer of building materials, and the distributor, as they apply to the planning and erection of buildings.

Other broad areas of technology possessing many of the field-oriented characteristics of the type mentioned are also found in agriculture, business, and medicine.

Job-oriented training of the industrial technician emphasizes a high level of proficiency within a narrower range. Here the training is of a fairly narrow scope of content but of a high level of ability within the range. A list of typical job titles suggests the required training: mechanical draftsman, materials tester, field service man, engine tester, production planner, quality-control analyst, time study man, cost estimator, plant layout draftsman, electrical draftsman, electrical estimator, chemical analyst, assistant chemist, control chemist, process technician, architectural draftsman, construction foreman, materials expediter, structural draftsman, surveyor, etc.

Some characteristic differences between the field-oriented and the job-oriented technician are summarized in the table below.

It is obvious from the aforementioned discussion that use of the term "technician" devoid of the prefix *industrial* or *engineering* can lead to nothing but misinterpretation. Recognition of this fact by both education and industry can do a lot in helping clarify an already clouded situation. Recognition of the difference by educators can clear the way for a full-fledged attack on the problem of curriculum development thus eliminating a vast amount of duplication of effort and haphazard planning. It's high time we defined the "technician" as *industrial* or *engineering.*

FIELD-ORIENTED VERSUS JOB-ORIENTED TECHNICIANS

General Characteristics	*Engineering Technician (Field oriented)*	*Industrial Technician (Job oriented)*
Individual	Usually interested in a broad technical area	Usually wants a specific job or has a narrow field of interest
Training	Formal, field-oriented, received at an institute of higher learning such as technical institutes, junior colleges, etc.	Formal or informal, job-oriented, received in industry or at a vocational-technical school
Knowledge and manipulative skills	Minimum manipulative skills, maximum knowledge; broader treatment of mathematics and science, characterized by development of value judgment in addition to information and skills	Varying degrees of manipulative skills and related knowledge, depending on area of technology, mathematics and science specific to area of study
Initial responsibility in industry	Specific, usually of an orientation type	Specific, usually of a productive type
Eventual responsibility in industry	Broad, usually supervision or design	Specific, charged with a specified area, usually without supervisory responsibility
Necessary supervision	Functions mainly on own initiative under direction of engineer or scientist	Requires supervision, reports to engineering technician or department head

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(EDITOR'S NOTE: The foregoing article was published, slightly abridged, in *Technical Education News,* June, 1963, issue, published by McGraw-Hill Book Co.)

Section 2

Institutions Offering Technician Training

Directory of Institutions Offering Technician Training

THIS directory of schools, colleges, and other institutions offering technician training has been compiled with the help of state directors of technical and vocational education, the Technical Education Branch of the U.S. Office of Education, the American Association of Junior Colleges, and the individual institutions involved.

Since this is the first time a nationwide directory of technician-training institutions has been compiled, and since the field is growing rapidly with some wide variations in definitions of technician training, there undoubtedly are omissions of schools that should be included and inclusions of other schools about which there may be questions as to whether they are offering strictly technician-training courses or other but similar types of courses.

In a majority of cases, the data in the listing were obtained from questionnaires returned by the institutions themselves. The administrators of the schools indicated the names and types of curriculums and courses offered, and, normally, the administrator's listings were accepted.

The technician curriculums listed without any identification mark following are preparatory curriculums (usually two years in length and requiring full-time attendance). An asterisk (*) following the listing indicates that the course is offered as an extension program (usually of varying lengths of time and requiring only part-time attendance). Two asterisks (**) indicates that the subject is offered both as a preparatory curriculum and as an extension course. A dagger (†) indicates that the curriculum has been approved by the Engineers' Council for Professional Development (ECPD).

Abbreviations used in the listings:

Accreditation Associations

MSA—Middle States Association of Colleges and Secondary Schools
NCA—North Central Association of Colleges and Secondary Schools
NEA—New England Association of Colleges and Secondary Schools
NHSC—National Home Study Council
NWA—Northwest Association of Secondary and Higher Schools
SA—Southern Association of Colleges and Schools
WA—Western Association of Colleges and Schools

Other Abbreviations

ACT—American College Testing
CEEB—College Entrance Examination Board
GATB—General Aptitude Test Battery
GEDT—General Educational Development Test
SAT—Scholastic Aptitude Test
ad. ed.—adult education
adm.—administrator
chm.—chairman
dir.—director
ind. ed.—industrial education
pres.—president
prin.—principal
supt.—superintendent
supv.—supervisor
voc. ed.—vocational education

ALABAMA

Alabama Agricultural and Mechanical College, Normal
Public. R. D. Morrison, pres.
Total enrolment: 1,100
Technician enrolment: 46
Accreditation: State Ed. Dept.
Admission: High-school graduation or equivalent
Electronics technology, mechanical design technology

Alabama Institute of Aviation Technology, 1439 S. Union Ave., Ozark
Public. Troy Tallis, dir.
Technician enrolment: 12
Admission: High-school graduation
Aircraft technology

Alabama School of Trades, 1001 E. Broad St., Gadsden
Public. E. L. Darden, dir.
Total enrolment: 450
Technician enrolment: 110
Accreditation: State Ed. Dept.
Admission: Well screened—varies with difficulty of course
Airconditioning and heating technology, civil technology, drafting technology, architectural drafting technology, electrical technology, electronics technology, industrial electronic technology, drafting and tool design, machine drafting and design, machine tool technology, mechanical design technology, mechanical technology, printing and photoengraving technology, welding technology

Butler High School, Huntsville
Public
Electronics*

Calhoun County Vocational-Technical School, P. O. Box 193, Jacksonville
Public. A. B. Garmon, supv.
Technician enrolment: 11
Admission: High-school graduation
Electronics**

Cullman High School, Cullman
Public
Electronics*

Decatur High School, Decatur
Public
Electronics*

Deshler High School, Tuscumbia
Public. Jack H. Vardaman, prin.
Technician enrolment: 14
Admission: High-school graduation
Electronics technology

Fairfield High School, Fairfield
Public.
Electronics*

Jefferson County Vocational-Technical School, 1318 Alabama St., Tarrant
Public. Otto Smith, dir.
Technician enrolment: 188
Admission: High-school graduation
Electronics**, industrial electronic technology**

John M. Patterson State Vocational Technical School, P. O. Box 6199, Montgomery
Public. J. O. McCollough, dir.
Total enrolment: 253
Technician enrolment: 65
Accreditation: State Ed. Dept.
Admission: High-school graduation, or take an aptitude test administered by State Employment Service
Electronic data processing technology, electronics technology, mechanical design technology

Mobile State Vocational-Technical School, 925 Dauphin Island Parkway, Mobile
Public. Clay Knight, dir.
Technician enrolment: 63
Admission: High-school graduation
Electronics technology, mechanical technology, drafting technology

Shelton State Vocational Technical School, Drawer J, East Side Station, Tuscaloosa
Public. H. I. James, dir.
Total enrolment: 300
Technician enrolment: 36
Accreditation: State Ed. Dept.
Admission: High-school graduation with math and science
Electronic data processing technology, electronics technology

Talladega High School, Talladega
Public. Frank Harwell, supt.
Technician enrolment: 9
Admission: High-school graduation
Electronics technology

Tennessee Valley State Vocational-Technical School, P.O. Box 337, Decatur
Public. Carlton Kelley, dir.
Technician enrolment: 133
Admission: High-school graduation
Electronics technology, instrumentation, drafting technology

United Electronics Institute, 2717 7th Ave., So., Birmingham. Home office: 3947 Park Drive, Louisville, Kentucky
Private. W. L. Rector, pres.
Total enrolment: 5,796
Technician enrolment: 5,796
Electronics technology**

Vigor High School, 100 Carlen St., Mobile
Public
Electrical technology*

Walker County High School, Jasper
Public. Geddes Self, prin.
Technician enrolment: 19
Admission: High-school graduation
Electronics technology**

ALASKA

Anchorage Community College, 1700 West Hillcrest Drive, Anchorage
Public. E. Short, res. dir.
Total enrolment: 1,600
Technician enrolment: 600
Accreditation: NWA
Admission: High-school graduation and 19 yrs. old.
Automotive technology*, aeronautical technology*, civil and construction technology*, electronic data processing technology*, drafting technology*, electronics technology**

ARIZONA

Arizona State College, Flagstaff
Public. J. L. Walkup, pres.
Total enrolment: 3,340
Technician enrolment: 130
Accreditation: NCA
Admission: High-school graduation
Civil technology, drafting technology, electrical technology, electronics technology

Mesa High School, Mesa
Public. R. A. Kilbourne
Total enrolment: 2,100
Technician enrolment: 24
Accreditation: NCA
Electronics technology*

Phoenix College, Phoenix
Public. R. J. Hannelly, dean
Total enrolment: 4,500
Technician enrolment: 212
Accreditation: NCA
Admission: High-school graduation; a year active military service; GED test
Automotive technology*, airconditioning and heating technology*, aeronautical technology*, aviation electronic technology*, electronic data processing technology, drafting technology, architectural drafting technology*, electronic technology, drafting and tool design*

PHOENIX UNION HIGH SCHOOL, 512 E. Van Buren, Phoenix
Public. R. E. McCullar, prin.
Total enrolment: 5,306
Technician enrolment: 143
Accreditation: NCA
Admission: High-school graduation or equivalent, also open to some 12th grade students with aptitudes for a desired offering
Airconditioning and heating technology, drafting technology, electromechanical technology, drafting and tool design

ARKANSAS

ARKANSAS VOCATIONAL TECHNICAL SCHOOL, 2220 W. 18th, Pine Bluff
Public. L. Coker, prin.
Total enrolment: 359
Technician enrolment: 140
Admission: 16 yrs. or older and high-school graduation for preparatory technician curriculums, no requirements for extension tech. courses
Automotive technology**, drafting technology**, architectural drafting technology**, electronics technology, industrial electronic technology**, machine tool technology

EL DORADO CITY SCHOOL, El Dorado
Public. C. W. Easley, supv.
Total enrolment: 1,800
Technician enrolment: 136
Accreditation: NCA
Automotive technology*, airconditioning and heating technology*, pneumatic controls instrumentation*

FAYETTEVILLE SENIOR HIGH SCHOOL, Fayetteville
Public. W. White, supt.
Technician enrolment: 15
Drafting technology

FORT SMITH JUNIOR COLLEGE, Fort Smith
Private. T. E. Vines, pres.
Technician enrolment: 80
Electronics technology, drafting technology, metallurgical technology, automotive technology

JONESBORO HIGH SCHOOL, Jonesboro
Electronics technology*, mechanical technology*

LITTLE ROCK UNIVERSITY, Little Rock
Private. C. V. Stabler, pres.
Total enrolment: 2,100
Technician enrolment: 200
Accreditation: NCA
Admission: High-school graduation with satisfactory ACT scores, adults considered without graduation—GEDT acceptable
Drafting technology, electrical technology**, electromechanical technology**, electronics technology**, industrial electronic technology**, industrial technology*, drafting and tool design, mechanical technology, metallurgical technology**

PETIT JEAN VOCATIONAL TECHNICAL SCHOOL, Morrilton
Public. T. Kirk, supt.
Highway technology, data processing technology, printing technology, automotive technology

TECHNICAL HIGH SCHOOL, Little Rock
Public. F. Parsons, supt.
Total enrolment: 125
Technician enrolment: 125
Electronics technology, metallurgical technology, automotive technology

CALIFORNIA

AMERICAN RIVER COLLEGE, 4700 College Oak Drive, Sacramento 41
Public. B. J. Priest, pres.
Total enrolment: 3,534
Technician enrolment: 500
Accreditation: State Ed. Dept., WA
Admission: High-school graduation, non-high-school graduates over 18 yrs. with demonstrated ability
Electronic data processing technology†, drafting technology†, electronics technology†

ANAHEIM EVENING HIGH SCHOOL, P.O. Box 3520, Anaheim
Public. Donald L. Bordsen, prin.
Total enrolment: 7,061
Accreditation: State Ed. Dept.
Industrial electronics technology, electronic data processing technology, machine tool technology, mechanical technology, printing and photoengraving technology

ANTELOPE VALLEY COLLEGE, Lancaster
Public. J. Starr, pres.
Total enrolment: 1,235 day, 1,566 ext. day
Technician enrolment: 302
Accreditation: WA, State Ed. Dept.
Admission: Satisfactory score on placement test
Aviation electronic technology, electronic data processing technology, drafting technology, electrical technology

BAKERSFIELD COLLEGE, 1801 Panorama Drive, Bakersfield
Public. E. Simonsen, pres.
Total enrolment: 3,200
Technician enrolment: 150
Accreditation: WA
Admission: Calif.—high-school graduation; out-of-state—individual basis, C+ in high school
Automotive technology, electronic data processing technology, drafting technology, architectural drafting technology, electrical technology, electronics technology, industrial electronic technology, industrial technology, mechanical technology, engineer aide

BARSTOW COLLEGE, 448 South First St., Barstow
Public. L. E. Wilbur, pres.
Total enrolment: 1,131
Accreditation: WA
Admission: High-school graduation or 18 yrs. old
Electronic data processing technology, architectural drafting technology, electronics technology, industrial technology, mechanical technology

BELMONT ADULT SCHOOL, Los Angeles
Public. H. P. Lea, prin.
Total enrolment: 10,000
Technician enrolment: 3,000
Accreditation: U. of Calif.
Admission: Open to adults (18 yrs. or older)
Electronic data processing technology, drafting technology, architectural drafting technology

BERKELEY EVENING HIGH SCHOOL, Berkeley
Public
Data processing*

BERKELEY TRADE EVENING HIGH SCHOOL, Berkeley
Public. W. H. Miller, prin.
Electronics*, nucleonics*

BURBANK EVENING HIGH SCHOOL, Burbank
Public. C. H. Read, prin.
Total enrolment: 5,000
Technician enrolment: 1,000
Accreditation: State Ed. Dept.
Admission: Standard state requirements
Automotive technology*, aeronautical technology*, electronic data processing technology*, drafting technology*, electrical technology*, electronics technology*, industrial electronic technology*, drafting and tool design*, machine tool technology*

CABRILLO COLLEGE, 6500 Soquel Drive, Watsonville
Public. F. L. Younger, dir. of instr.
Total enrolment: 2,300
Technician enrolment: 120
Accreditation: WA
Admission: High-school graduation or 18 yrs. old

Civil and construction technology, drafting technology, electronic technology

CENTINELA EVENING HIGH SCHOOL, Lennox
Public
Electronics*

CERRITOS COLLEGE, 11110 E. Alondra Blvd., Norwalk
Public. Jack W. Mears, pres.
Total enrolment: 7,488
Accreditation: WA
Admission: High-school graduation or 18 yrs. old.
Chemical technology*, metallurgical technology*, electrical technology*, electronics technology*, mechanical technology**

CHABOT COLLEGE, 1177 Aladdin Ave., San Leandro
Public. R. L. Buffington, pres.
Total enrolment: 4,000
Accreditation: WA
Admission: High-school graduation or 18 yrs. or older and able to profit from instruction
Electronic data processing technology*, drafting technology, electronics technology*, industrial electronic technology*

CHAFFEY COLLEGE, Alta Loma
Public. D. B. Milliken, pres.
Total enrolment: 3,981
Accreditation: WA
Admission: 18 yrs. of age and ability to benefit from program
Aeronautical technology, aviation electronic technology, drafting technology, architectural technology, electronics technology, industrial electronic technology, printing and photoengraving technology

CITRUS COLLEGE, Azusa
Public. Glenn G. Vaniman, pres.
Total enrolment: 3,967
Accreditation: WA
Admission: High-school graduation or 18 yrs. old
Electronics*, missiles*

CITY COLLEGE OF SAN FRANCISCO, San Francisco
Public. L. G. Conlan, prin.
Total enrolment: 8,239
Technician enrolment: 3,000
Accreditation: WA
Admission: High-school graduation or satisfactory scores on entrance exam
Architectural engineering technology†, building and contracting technology†, civil engineering technology†, design drafting technology†, electrical engineering technology†, electronic engineering technology†, general engineering technology†, mechanical engineering technology.†

COGSWELL POLYTECHNICAL COLLEGE, 3000 Folsom St., San Francisco 10
Private. E. W. Smith, pres.
Total enrolment: 167
Admission: High-school graduation with ability in science and math
Architectural and civil technology†, electrical and electronics technology†, mechanical technology†

COLLEGE OF MARIN ADULT SCHOOL, Kentfield
Public. S. E. Epler, pres.
Total enrolment: 3,000
Technician enrolment: 60
Accreditation: WA
Admission: High-school graduation or over 18 yrs. old
Electronics technology, mechanical technology, civil technology, automotive technology

COLLEGE OF THE DESERT, Palm Desert
Public. R. C. McCall, pres.
Total enrolment: 3,000
Technician enrolment: 85
Accreditation: WA
Admission: High-school graduation
Automotive technology, drafting technology, architectural drafting technology, electronics technology, industrial technology, machine tool technology

COLLEGE OF THE SISKIYOUS, R. 1, Box 1225, Weed
Public. W. E. Roberts, pres.
Total enrolment: 2,009
Accreditation: WA
Admission: High-school graduation or 18 yrs. old
Electrical and electronics technology

CONTRA COSTA JUNIOR COLLEGE, 2801 Castro Road, San Pablo
Public. G. J. Faul, dir.
Total enrolment: 5,500
Technician enrolment: 200
Accreditation: WA
Admission: Varies according to individual programs.
Civil technology**, electronic data processing technology**, architectural drafting technology, electronics technology**, chemical technology, welding technology

CUBBERLY EVENING HIGH SCHOOL, Palo Alto
Public. T. F. Damon, prin.
Total enrolment: 2,000
Technician enrolment: 450
Automotive technology*, electronic data processing technology*, drafting technology*, electronics technology*, welding*

DIABLO VALLEY COLLEGE, Golf Club Rd., Concord
Public. K. O. Drexel, dir.
Total enrolment: 7,177
Technician enrolment: 560
Accreditation: WA
Admission: High-school graduation or 21 yrs. or older
Drafting technology, electrical technology, electronics technology, industrial electronic technology, instrumentation, construction superintendents

DOWNEY EVENING HIGH SCHOOL, Downey
Public
Electronics*

EAST LOS ANGELES COLLEGE, 5357 E. Brooklyn Ave., Los Angeles 22
Public. B. K. Swartz, pres.
Total enrolment: 8,767
Accreditation: WA
Admission: High-school graduation or qualified, mature student over 18
Construction technology**, electronic data processing technology, architectural drafting technology**, electrical technology**, electronics technology, drafting and tool design

EL CAMINO COLLEGE, El Camino
Public. S. E. Marsu, pres.
Total enrolment: 12,506
Accreditation: WA
Admission: High-school graduation or 18 yrs. or older
Chemical technology*, metallurgical*, electronics technology**, mechanical technology**, industrial technology*, air conditioning technology

EL MONTE EVENING HIGH SCHOOL, El Monte
Public
Data processing*

EUREKA CITY SCHOOLS ADULT SCHOOL, 1915 J Street, Eureka
Public. L. L. Kavich, prin.
Total enrolment: 3,700
Technician enrolment: 400
Accreditation: WA
Admission: Previous course work or experience
Automotive technology*, drafting technology*, electronics technology*, machine tool technology*, mechanical design technology*

FOOTHILL COLLEGE, 12345 El Monte Road, Los Altos Hills
Public. C. C. Flint, supt.-pres.
Total enrolment: 4,400
Technician enrolment: 450
Accreditation: WA, State Ed. Dept.
Admission: High-school graduation
Drafting technology**, electronic data processing technology**, electronics technology**, technical illustration**

FRESNO CITY COLLEGE, 1101 University Ave., Fresno
Public. Stuart M. White, pres.
Total enrolment: 6,000
Technician enrolment: 1,455
Accreditation: WA
Admission: High-school graduation or over 18 yrs. old
Airconditioning and heating technology*, aeronautical technology*, drafting technology, architectural drafting technology, electrical technology, electronic technology, industrial technology, instrumentation

FULLERTON JUNIOR COLLEGE, Fullerton
Public. H. L. Sheller, pres.
Total enrolment: 10,000
Technician enrolment: 1,000
Accreditation: WA and State Ed. Dept.
Admission: High-school graduation or equivalent
Automotive technology**, civil technology**, civil and construction technology**, electronic data processing technology**, drafting technology**, architectural drafting technology**, electrical technology**, electromechanical technology**, electronics technology**, industrial electronic technology**, industrial technology**, drafting and tool design**, machine drafting and design**, metallurgical technology**, printing and photoengraving technology

GLENDALE COLLEGE, 1500 North Verougo Rd., Glendale
Public. R. D. Haugh, pres.
Total enrolment: 3,000
Technician enrolment: 800
Accreditation: WA
Admission: High-school graduation or over 18 yrs. old
Aeronautical technology, drafting technology, architectural drafting technology, electronic technology, drafting and tool design, machine tool technology, technical illustrations

GRANTHAM SCHOOL OF ELECTRONICS, 1505 N. Western Ave., Hollywood
Private. Donald J. Grantham, pres.
Total enrolment: 1,500
Accreditation: National Home Study Council
Admission: High-school graduation or equivalent
Electronic technology

HANFORD EVENING HIGH SCHOOL, Hanford
Public. R. K. Attebery, prin.
Total enrolment: 521
Technician enrolment: 20
Accreditation: U. of Calif.
Architectural drafting technology

HUNTINGTON PARK ADULT SCHOOL, 6020 Miles Ave., Huntington Park
Public. A. A. McIntyre, dir.
Total enrolment: 2,400
Accreditation: State Ed. Dept.
Drafting technology, architectural technology, electronics technology, drafting and tool design, machine drafting and design

JOHN A. O'CONNELL EVENING VOCATIONAL HIGH SCHOOL AND TECHNICAL INSTITUTE, San Francisco
Electrical technology*, electronics technology*, mechanical technology*, nucleonics*

LINCOLN EVENING HIGH SCHOOL, Los Angeles
Public. F. R. Ames, prin.
Plastics technology*

LONG BEACH CITY COLLEGE, BUSINESS AND TECHNOLOGY DIVISION, Long Beach
Public. G. E. Dotson, prin.
Total enrolment: 24,047
Accreditation: WA
Admission: High-school graduation
Aeronautical technology**, chemical technology*, data processing**, electronic technology**, mechanical technology**, civil and construction technology**, industrial technology**

LOS ANGELES CITY COLLEGE, Los Angeles
Public. J. Lombardi, pres.
Total enrolment: 17,119
Accreditation: WA
Admission: High-school graduation
Electronics**, mechanical technology**, aeronautical technology, architectural and civil technology, chemical technology

LOS ANGELES EVENING HIGH SCHOOL, Los Angeles
Public. P. Chambers, prin.
Total enrolment: 4,500
Technician enrolment: 95
Accreditation: U. of Calif.
Electronics technology*, drafting and tool design*, machine drafting and design*

LOS ANGELES HARBOR COLLEGE, 1111 Figueroa Place, Wilmington
Public. W. C. Black, pres.
Total enrolment: 4,500
Technician enrolment: 320
Accreditation: WA
Admission: High-school graduation
Civil and construction technology, drafting technology, architectural drafting technology, electrical technology, electronics technology, drafting and tool design, machine tool technology, instrumentation, printing and photo engraving, petroleum technology, chemical technology, engine technology

LOS ANGELES PIERCE COLLEGE, Woodland Hills
Public. J. B. Shepard, pres.
Total enrolment: 4,200
Technician enrolment: 400
Accreditation: WA
Admission: High-school graduation or 18 yrs. or older
Aviation electronic technology**, drafting technology**, electrical technology**, electromechanical technology**, electronics technology**, industrial electronic technology**, industrial technology, drafting and tool design**, machine drafting and design**, machine tool technology**, metallurgical technology**, electronics drafting

LOS ANGELES TRADE-TECHNICAL COLLEGE, 400 West Washington Blvd., Los Angeles 15
Public. F. P. Wilber, pres.
Total enrolment: 10,400
Technician enrolment: 8,000
Accreditation: WA
Admission: Aptitude tests, 18 yrs. or older or high-school graduation, ability to profit by instruction
Automotive technology**, airconditioning and heating technology**, aeronautical technology**, aviation electronic technology**, electronic data processing technology*, drafting technology**, architectural drafting technology**, electrical technology**, electromechanical technology*, electronics technology**, industrial electronic technology**, industrial technology**, drafting and tool design**, machine drafting and design**, machine tool technology*, mechanical technology**, metallurgical technology**, printing and photoengraving technology**

LOS ANGELES VALLEY COLLEGE, 5800 Fulton Ave., Van Nuys
Public. W. McMellis, pres.
Total enrolment: 13,300
Technician enrolment: 1,400
Accreditation: WA
Admission: High-school graduation or 18 yrs. or over and ability to profit from instruction

Aviation electronic technology*, electronic data processing technology**, drafting technology**, electronics technology**, drafting and tool design*, business data processing**, computer technology**

MANUAL ARTS EVENING HIGH SCHOOL, Los Angeles
Public. D. L. Pennington, prin.
Electronics*

MANUAL ARTS HIGH SCHOOL, Los Angeles
Public. R. T. Cooper, prin.
Total enrolment: 3,100
Technician enrolment: 1,500
Electronic technology

MONTEREY PENINSULA COLLEGE, P. O. Box 1231, Monterey
Public. F. Huber, pres.
Total enrolment: 3,700
Technician enrolment: 750
Accreditation: WA
Admission: 18 yrs. or older or high-school graduation
Civil technology, electronic data processing technology, electronics technology, industrial electronic technology

MOUNTAIN VIEW-LOS ALTOS ADULT SCHOOL, Box 640, Mountain View
Public. L. S. Allen, dir.
Total enrolment: 3,036
Technician enrolment: 162
Accreditation: WA
Admission: High-school graduation, 19 yrs. old, or married
Drafting technology, electronics technology, drafting and tool design

MOUNT SAN ANTONIO COLLEGE, Walnut
Public. O. H. Edinger, Jr., pres.
Total enrolment: 9,656
Accreditation: WA
Admission: High-school graduation or 18 yrs. or older
Airconditioning and heating technology*, aeronautical technology**, aviation electronic technology*, civil technology*, civil and construction technology*, electronic data processing technology*, drafting technology**, architectural drafting technology*, electrical technology**, electronics technology**, industrial electronic technology**, industrial technology**, drafting and tool design**, machine drafting and design*, machine tool technology**, mechanical design technology**, mechanical technology**, instrumentation*, printing and photoengraving technology*

NORTHROP INSTITUTE OF TECHNOLOGY, 1155 W. Arbor Vitae St., Inglewood 1
Private. H. W. Hartley, pres.
Total enrolment: 1,500
Technician enrolment: 200
Accreditation: WA
Admission: High-school graduation
Aeronautical technology†, electronics technology†, engineering technology†

OAKLAND CITY COLLEGE, Laney Campus, Oakland
Public. J. E. Brookins, dir.
Total enrolment: 9,020
Accreditation: WA
Admission: High-school graduation or over 18 yrs. old
Chemical technology*, metallurgical technology*, electrical technology, electronics technology**, mechanical technology, plastics**

ORANGE COAST COLLEGE, 2701 Fairview Road, Costa Mesa
Public. B. H. Peterson, pres.
Total enrolment: 4,300
Technician enrolment: 600
Accreditation: WA
Admission: High-school graduation or 18 yrs. or older
Automotive technology**, civil technology**, electronic data processing technology**, drafting technology**, architectural drafting technology**, electromechanical technology**, electronics technology**, drafting and tool design**, sheet metal technology**, building construction technology**, metal trades technology**, petroleum technology**

PACIFIC HIGH SCHOOL, San Bernardino
Public. K. P. Bailey, prin.
Electronics

PALOMAR COLLEGE, San Marcos
Public. J. W. Dunn, pres.
Total enrolment: 3,400
Technician enrolment: 130
Accreditation: WA
Admission: High-school graduation
Automotive technology*, drafting technology, electronics technology

PASADENA CITY COLLEGE, Pasadena
Public. C. J. Robbins, pres.
Total enrolment: 25,948
Accreditation: WA
Admission: High-school graduation or over 18 yrs. old
Aeronautical technology, chemical technology*, metallurgical technology*, electronics technology**, mechanical technology, missiles technology*, nucleonics technology*, industrial technology**

PHINEAS BANNING ADULT SCHOOL, 1500 Avalon Blvd., Wilmington
Public. W. E. Holstein, prin.
Total enrolment: 1,982
Technician enrolment: 688
Admission: High-school graduation or 18 yrs. or older, or high-school dropout with day principal's request
Automotive technology*, airconditioning and heating technology*, aviation electronic technology*, drafting technology*, electrical technology*, electronics technology*, industrial electronic technology*, industrial technology*, drafting and tool design*, mechanical design technology*, mechanical technology*, nucleonics*

REEDLEY COLLEGE, Reedley
Public. C. M. Boyer, pres.
Total enrolment: 1,300
Technician enrolment: 140
Accreditation: WA
Admission: High-school graduation or 18 yrs. or older
Automotive technology, aeronautical technology, electronics technology

ROOSEVELT ADULT SCHOOL, 450 South Fickett Street, Los Angeles
Public. G. L. Gardner, prin.
Total enrolment: 2,055
Technician enrolment: 240
Accreditation: State Ed. Dept.
Drafting technology, automotive technology, electrical technology, electronics technology

SACRAMENTO CITY COLLEGE, Sacramento
Public. H. H. Stephenson, pres.
Total enrolment: 4,061
Technician enrolment: 711
Accreditation: WA
Admission: High-school graduation, or 18 yrs. or older with demonstrated ability
Automotive technology, aeronautical technology, civil technology*, civil and construction technology, architectural drafting technology, electronics technology, industrial electronic technology, industrial chemical technology, mechanical engineering technology

SAN BENITO COLLEGE, Hollister
Public. R. Schroder, dir.
Total enrolment: 300
Accreditation: WA
Admission: High-school graduation or 18 years or older and able to profit from post-high-school education
Civil technology, electronics technology

SAN BERNARDINO VALLEY COLLEGE, San Bernardino
Public. H. J. Sheffield, pres.
Total enrolment: 8,200
Accreditation: WA
Admission: High-school graduation or

over 18 years of age and able to profit from instruction
Automotive technology**, airconditioning and heating technology**, aeronautical technology**, civil technology**, electronic data processing technology*, drafting technology**, architectural drafting technology**, electrical technology**, electronics technology**, industrial electronic technology**, industrial technology, mechanical technology**

San Diego City College, San Diego
Public. R. Gorton, dir.
Total enrolment: 11,654
Accreditation: WA
Admission: High-school graduation
Chemical and metallurgical technology*, civil technology*, data processing technology**, electrical technology, electronics technology**, mechanical technology**, industrial technology*

San Jose City College, 2100 Moorpark, San Jose
Public. H. R. Buchser, pres.
Total enrolment: 10,000
Technician enrolment: 1,800
Accreditation: WA
Admission: High-school graduation or 19 yrs. or older, with ability to profit from instruction
Automotive technology, airconditioning and heating technology*, electronic data processing technology, drafting technology, electrical technology, electronics technology**, drafting and tool design technology**, machine tool technology**, printing technology**, welding technology**, engineering technology

San Leandro Evening High School, San Leandro
Public. W. R. Dennon, prin.
Electronics**

Santa Ana College, Santa Ana
Public. J. E. Johnson, pres.
Total enrolment: 4,720
Accreditation: State Ed. Dept. and WA
Admission: High-school graduation or 18 yrs. or older
Automotive technology, drafting technology, architectural drafting technology; electrical technology, electronics technology, drafting and tool design, machine drafting and design, machine tool technology

Santa Ana Evening College, Santa Ana
Electronics*, mechanical*

Santa Barbara City College, Santa Barbara
Public. D. C. White, act. prin.
Total enrolment: 1,500
Technician enrolment: 175
Accreditation: WA
Admission: High-school graduation or over 18 yrs. old
Automotive technology, airconditioning and heating technology*, electronics technology**, printing technology

Santa Monica City College, Santa Monica
Public. W. F. Thomas, pres.
Total enrolment: 12,000
Technician enrolment: 2,000
Accreditation: WA
Admission: High-school graduation or 18 yrs. or older
Automotive technology**, civil and construction technology**, drafting technology**, architectural drafting technology**, electrical technology**, electronics technology**, industrial electronic technology**, drafting and tool design**, machine tool technology**, printing and photoengraving technology**, welding technology**, electronic drafting**

Shasta College, Redding
Public. G. A. Collyer, pres.
Total enrolment: 1,400
Technician enrolment: 50
Accreditation: WA
Admission: High-school graduation or 18 yrs. or older
Drafting technology, electronics technology

South Gate Adult School, 3351 Firestone Blvd., South Gate
Public. L. E. Hotchkiss, prin.
Total enrolment: 1,340
Automotive technology*, drafting technology*, architectural drafting technology*, electrical technology*, electronics technology*, industrial electronic technology*, printing technology*

Taft College, Taft
Public. R. L. Matthai, dean
Total enrolment: 850
Technician enrolment: 150
Accreditation: WA
Admission: High-school graduation or 18 yrs. or older
Automotive technology, civil and construction technology, drafting technology, architectural drafting technology, electronics technology, industrial technology

University Evening High School, Los Angeles
Public
Electronics*

Vallejo College, Whitney at Mini Dr., Vallejo
Public. C. A. McDonald, pres.
Total enrolment: 1,900
Technician enrolment: 253
Accreditation: WA
Admission: High-school graduation or 18 yrs. or older
Automotive technology**, construction technology**, electrical technology*, electronics technology*, mechanical technology, metallurgical technology*, photography technology

Van Nuys Evening High School, Van Nuys
Public.
Electrical technology*, electronics technology*, mechanical technology*, industrial technology*

Ventura College, Ventura
Public. E. H. Rowins, pres.
Total enrolment: 4,901
Accreditation: WA
Admission: High-school graduation or 18 yrs. or older
Civil technology**, electronic data processing technology*, drafting technology*, architectural drafting technology*, electrical technology*, electromechanical technology*, electronics technology**, industrial electronic technology**, drafting and tool design*, machine technology*, mechanical design technology**, automotive technology*, welding technology*

Victor Valley College, Victorville
Public. F. F. Berger, pres.
Total enrolment: 1,051
Accreditation: WA
Admission: High-school graduation or 18 yrs. or older
Drafting technology, electronics technology

Washington High School, Los Angeles
Public. W. K. Jordan, prin.
Electronics*

COLORADO

Adams State College, Alamosa
Public. F. Plachy, pres.
Total enrolment: 1,700
Technician enrolment: 50
Accreditation: NCA
Admission: Upper ⅔ high-school graduating class and recommendation of principal
Drafting technology

Boulder High School, Boulder
Public. B. F. Allen, dir.
Accreditation: NCA

Admission: Specified in Title VIII, Area Vocational Education, NDEA
Electronics technology, electronics drafting

Boulder Valley Vocational-Technical Center, P. O. Box 186, Boulder
Public. Basil F. Allen, dir.
Total enrolment: 200
Technician enrolment: 75
Accreditation: State Bd. for Voc. Ed.
Admission: Testing and screening by admissions committee
Automotive technology**, electronic data processing technology*, drafting technology**, electrical technology**, electronics technology*

Emily Griffith Opportunity School, Denver
Public. R. L. Casement, prin.
Total enrolment: 34,000
Technician enrolment: 400
Accreditation: NCA, State Ed. Dept.
Admission: Specified in Title VIII, Area Vocational Ed., NDEA
Electronics technology**, instrumentation technology*, data processing technology*

Lamar Junior College, Lamar
Public. H. C. Kelley, pres.
Total enrolment: 500
Technician enrolment: 100
Accreditation: State Ed. Dept.
Admission: High-school graduation
Electronics technology

Mesa County Junior College, Grand Junction
Public. W. A. Medesy, pres.
Total enrolment: 1,350
Technician enrolment: 20
Accreditation: NCA
Admission: Residents, high-school graduation. Non-residents, upper ½ of high-school graduating class
Electronic data processing technology**

Northeastern Junior College, Sterling
Public. E. S. French, pres.
Total enrolment: 667
Technician enrolment: 45
Accreditation: State Ed. Dept.
Admission: Residents, high-school graduation. Non-residents, upper ¾ of graduating class
Civil technology, electronics technology

Otero Junior College, La Junta
Public. G. G. Carnes, dir.
Total enrolment: 327
Technician enrolment: 26
Accreditation: State Ed. Dept.
Admission: Graduation from high school or equivalent
Civil technology, electronic data processing technology, machine drafting and design, mechanical technology, chemical technology, soils technology

Rangely College, Rangely
Public. N. A. Ivey, dean
Total enrolment: 113
Technician enrolment: 48
Accreditation: NCA
Admission: Special requirements for technician-training courses
Electronics technology

Southern Colorado State College, Pueblo
Public. M. C. Knudson, pres.
Total enrolment: 2,607
Technician enrolment: 575
Accreditation: NCA
Admission: Residents, high-school graduation. Non-residents, high-school graduation, and in upper ½ of graduating class. Those not in this category may gain admission through special action of the Admissions Committee
Automotive technology**, airconditioning and heating technology**, civil technology, electronic data processing technology**, electronics technology**, mechanical technology**, metallurgical technology**

Trinidad State Junior College, Trinidad
Public. C. O. Banta, dean
Total enrolment: 600
Technician enrolment: 250
Accreditation: NCA
Civil technology, drafting technology, electronics technology, drafting and tool design, chemical technology

CONNECTICUT

Bullard-Havens Technical School, Evening Institute, Bridgeport
Public. F. Okula, supv.
Total enrolment: 297
Accreditation: State Ed. Dept.
Admission: High-school graduation and passing engineering aptitude test
Chemical technology*, metallurgical technology**, electronics technology*, mechanical technology**

E. C. Goodwain Technical School, Evening Institute, New Britain
Public. K. Fogg, supv.
Total enrolment: 111
Accreditation: State Ed. Dept.
Admission: High-school graduation and passing engineering aptitude test
Electrical technology, electronics technology**, mechanical technology**

Eli Whitney Technical School, Evening Institute, Hamden
Public. J. Higgiston, supv.
Total enrolment: 129
Accreditation: State Ed. Dept.
Admission: High-school graduation and passing engineering aptitude test
Civil and construction technology, electrical technology, electronics technology, mechanical technology

Hartford State Technical Institute, 401 Flatbush Ave., Hartford
Public. T. V. Raimondi, dir.; J. Volk, supv., Evening Institute
Total enrolment: 360
Accreditation: State Ed. Dept.
Admission: High-school graduation or equivalent
Electrical technology**†, mechanical technology**†, tool technology†, data processing technology*

Henry Abbott Technical School, Evening Institute, Danbury
Public. O. Truderung, supv.
Total enrolment: 350
Technician enrolment: 175
Accreditation: State Ed. Dept.
Admission: High-school graduation and passing of engineering aptitude test
Civil technology, electrical technology, electromechanical technology, machine tool technology, mechanical technology

Horace C. Wilcox Technical School, Evening Institute, Meridan
Public. R. Dorsey, supv.
Total enrolment: 80
Accreditation: State Ed. Dept.
Admission: High-school graduation and engineering aptitude test
Civil and construction technology*, electrical technology*, electronics technology**, mechanical technology

J. M. Wright Technical School, Evening Institute, Stamford
Public. E. Kelly, supv.
Total enrolment: 1,884
Technician enrolment: 596
Accreditation: State Ed. Dept.
Admission: 2 units in mathematics, one unit in lab. science, entrance examination, high-school graduation
Electrical technology*, electromechanical technology*, electronics technology*, machine drafting and design*, machine tool technology*, mechanical technology*, metallurgical technology*

Norwalk State Technical Institute, Richards Ave., South Norwalk
Public. F. L. Juszli, dir.; C. S. Greco, dir., Evening Institute
Total enrolment: 960
Technician enrolment: 960

Accreditation: State Ed. Dept.
Admission: High-school graduation, two units in mathematics, one unit in laboratory science, entrance examination
Electronic data processing technology**, electrical technology**, electromechanical technology**, electronic technology**, mechanical technology**, metallurgical technology**, chemical technology**, tool technology**

NORWICH STATE TECHNICAL INSTITUTE, 574 New London Turnpike, Norwich
Public. D. R. Welter, dir.; J. Rooke, supv., Evening Institute
Total enrolment: 300
Technician enrolment: 300
Accreditation: State Ed. Dept.
Admission: High-school graduation, 2 yrs. math, and engineering and physical science aptitude test
Electronic data processing technology**, drafting technology*, electrical technology**, drafting and tool design*, machine drafting and design*, machine tool technology**, mechanical design technology*, mechanical technology**, metallurgical technology**, instrumentation*, chemical technology**

OLIVER WOLCOTT TECHNICAL SCHOOL, Evening Institute, Torrington
Total enrolment: 88
Admission: High-school graduation and passing of engineering aptitude test
Electrical technology*, mechanical technology*

PRINCE TECHNICAL SCHOOL, Hartford
Public. J. De Mino, dir.
Electronics technology**, mechanical technology**

WARD SCHOOL OF ELECTRONICS, University of Hartford, 44 Niles Street, Hartford 5
Private. R. F. Lescarbeau, dir.
Accreditation: State Ed. Dept., NEA
Admission: High-school graduation—2 yrs. math., 2 yrs. science, passing entrance exams
Electrical technology, electronics technology, industrial electronic technology, industrial technology, instrumentation

WARREN F. KAYNOR TECHNICAL SCHOOL, Evening Institute, Waterbury
Public. J. Rossi, actg. supv.
Total enrolment: 363
Accreditation: State Ed. Dept.
Admission: High-school graduation and engineering aptitude test
Electrical technology, mechanical technology**

WINDHAM TECHNICAL SCHOOL, Willimantic
Public
Electronics technology**, mechanical technology

DELAWARE

SUSSEX COUNTY VOCATIONAL-TECHNICAL CENTER, Georgetown
Public. W. C. Utz, chm.
Electronics technology, mechanical technology

DISTRICT OF COLUMBIA

CAPITOL RADIO ENGINEERING INSTITUTE, 3224 16th St., N.W., Washington 10
Private. E. H. Rietzke, pres.
Total enrolment: 750
Technician enrolment: 750
Admission: High-school graduation
Aviation electronic technology*, electronic engineering technology**†, industrial electronic technology*, instrumentation*

FLORIDA

ALACHUA COUNTY VOCATIONAL SCHOOL, 1817 E. University Ave., Gainesville
Public. M. L. Bishop, dir., voc. ed.
Total enrolment: 1,200
Technician enrolment: 150
Accreditation: State Ed. Dept., SA
Admission: High-school graduation, math background, testing and evaluation by advisory committee
Drafting technology, electrical technology*, electronics technology*

BREVARD JUNIOR COLLEGE, 428 Delannoy Ave., Cocoa
Public. L. N. Donnell, dir.
Admission: High-school graduation
Electronics technology**, drafting design technology

BROWARD COUNTY VOCATIONAL SCHOOL, 400 E. Broward Blvd., Ft. Lauderdale
Public. J. L. Burnsted, dir.
Civil and construction technology**, electrical technology*, electronics technology*

CENTRAL FLORIDA JUNIOR COLLEGE, P. O. Box 1388, Ocala
Public. J. L. Murphy, dean of tech. ed.
Total enrolment: 800
Technician enrolment: 75
Accreditation: State Ed. Dept.
Admission: High-school graduation
Civil technology, drafting technology, electronics technology

CHIPOLA JUNIOR COLLEGE, P. O. Box 232, Marianna
Public. N. L. Haven, pres.
Total enrolment: 726
Technician enrolment: 35
Accreditation: SA
Admission: High-school graduation from approved school
Electronic data processing technology, drafting technology, electronics technology

DADE COUNTY AVIATION SCHOOL, 3275 N.W. 42nd Ave., Miami
Public. W. F. Smith, supv.
Total enrolment: 600
Technician enrolment: 600
Accreditation: SA
Admission: In top 50 percentile of high-school graduating class in all subject areas
Aeronautical technology**

DAYTONA BEACH JUNIOR COLLEGE, Daytona Beach
Public. E. E. Ek, dir.
Total enrolment: 1,200
Technician enrolment: 240
Accreditation: SA, State Ed. Dept.
Admission: High-school graduation
Civil technology, civil and construction technology, drafting technology*, architectural drafting technology*, electrical technology, electronics technology, drafting and tool design*, mechanical technology, instrumentation*

DIXIE HOLLINS HIGH SCHOOL, 4940 62nd St., N., St. Petersburg
Public. H. B. Lawson, prin.
Total enrolment: 1,940
Technician enrolment: 267
Accreditation: SA
Electronics technology

DUNEDIN HIGH SCHOOL, Dunedin
Public. H. R. Danford, prin.
Total enrolment: 1,071
Technician enrolment: 95
Accreditation: SA
Automotive technology, drafting technology, electronics technology

EMBRY-RIDDLE AERONAUTICAL INSTITUTE, 3240 N.W. 27th Ave., Miami
Private. J. R. Hunt, pres.
Total enrolment: 350
Technician enrolment: 280
Accreditation: Federal Aviation Agency
Admission: High-school graduation or equivalent
Aeronautical technology†, drafting technology

ESCAMBIA COUNTY VOCATIONAL SCHOOL, P. O. Box 1470, Pensacola
Public. E. G. Holly, dir.
Electronics technology*, instrumentation*

Florida Electronic Technical Institute, Inc., 105 King St., Cocoa
Private. E. A. Foster, dir.
Accreditation: State Ed. Dept.
Admission: High-school graduation or equivalent
Electronics technology**, industrial electronic technology**, electronic fundamentals, electronic communications

Gulf Coast Junior College, Panama City
Public. R. E. Morley, pres.
Total enrolment: 850
Technician enrolment: 60
Accreditation: SA
Admission: High-school graduation
Civil and construction technology, drafting technology, electronics technology

Indian River Junior College, 3209 Virginia Ave., Fort Pierce
Public. E. E. Potter, Jr., dir.
Total enrolment: 541
Technician enrolment: 78
Accreditation: State Ed. Dept.
Admission: High-school graduation
Drafting technology, electronics technology

Junior College of Broward County, 3501 Davie Road, SW, Ft. Lauderdale
Public. E. F. Kotchi, dir., tech. ed.
Total enrolment: 2,370
Accreditation: State Ed. Dept.
Admission: High-school graduation plus ability to do college level work
Civil and construction technology, electronic data processing technology, drafting technology, electronics technology, mechanical design technology

Lindsey Hopkins Educational Center, 1410 N.E. 2nd Ave., Miami 32
Public
Chemical and metallurgical technology*, data processing*, electronics technology**, mechanical technology*

Manatee Junior College, Bradenton
Public. B. R. Tinsley, Jr., dir., tech. ed.
Total enrolment: 1,674
Technician enrolment: 110
Accreditation: State Ed. Dept.
Admission: High-school graduation or equivalent, 3 yrs. math., satisfactory scores on aptitude and abilities test, and interview
Electronics technology, civil engineering technology, building construction technology, design drafting technology, industrial and business management

Massey Technical Institute, 148 E. 7th St., Jacksonville
Private. C. A. Barringer, pres.
Total enrolment: 350
Technician enrolment: 350
Admission: High-school graduation
Electronic data processing technology, drafting technology, architectural drafting technology, electronic technology**, industrial electronic technology, drafting and tool design, machine drafting and design

Miami Central Senior High School, 1781 N.W. 95 Street, Miami
Public. T. Carter, prin.
Total enrolment: 1,410
Technician enrolment: 500
Accreditation: SA, State Ed. Dept.
Admission: Varies for programs
Airconditioning and heating technology**, aeronautical technology, civil and construction technology, electronic data processing technology, drafting technology, electronics technology, machine drafting and design, mechanical technology, printing and photoengraving technology**

Miami-Dade Junior College, 11380 N.W. 27 Avenue, Miami
Public. T. A. Koschler, dean
Total enrolment: 12,000
Accreditation: State Ed. Dept.
Admission: High-school graduation and selective test scores
Airconditioning and heating technology**, aeronautical technology**, aviation electronic technology, civil technology, electronic data processing technology**, drafting technology, architectural drafting technology, drafting and tool design, mechanical design technology, instrumentation, printing and photoengraving technology

North Florida Junior College, Madison
Public. M. Hamilton, pres.
Total enrolment: 514
Technician enrolment: 41
Accreditation: State Ed. Dept.
Admission: Graduation from an accredited high school
Civil technology, electronic data processing technology

Palatka High School, Palatka
Public
Electronics technology*

Palm Beach Junior College, 4200 Congress Ave., Lake Worth
Public. D. C. Whitmer, chm., eng. tech. dept.
Total enrolment: 3,100
Technician enrolment: 100
Accreditation: SA
Admission: High-school graduation
Drafting technology, architectural drafting technology**, electronics technology**, machine drafting and design

Pensacola Junior College, 1000 College Blvd., Pensacola
Public. T. F. Harrison, dean of instr.
Total enrolment: 3,000
Technician enrolment: 175
Accreditation: SA and State Ed. Dept.
Admission: High-school graduation and minimum admission scores on SCAT
Drafting technology, electronics technology, machine drafting and design, industrial management

Pensacola Technical High School, 614 N. Palafox St., Pensacola
Public. N. B. Bevis, prin.
Total enrolment: 625
Technician enrolment: 20
Accreditation: State Ed. Dept.
Drafting technology, electronics technology

St. Petersburg Junior College, Technical Division, 5th Ave. and 66th St., N., St. Petersburg 10
Public. W. L. Bolin, dean
Total enrolment: 3,600
Technician enrolment: 200
Accreditation: SA
Admission: High-school graduation
Electronics technology**, mechanical design technology**

Southwest Miami Senior High School, 8855 S.W. 50th Terrace, Miami
Public
Mechanical technology*

Tampa Technical College, Inc., 3347 Henderson Blvd., Tampa
Private. A. Jank, pres.
Total enrolment: 300
Technician enrolment: 300
Admission: High-school graduation
Electronic data processing technology**, drafting technology, electronics technology**, industrial electronic technology**, drafting and tool design

Tomlinson Adult Education Center, 296 Mirror Lake Dr., St. Petersburg
Public. J. C. Hill, prin.
Total enrolment: 421
Technician enrolment: 37
Admission: 17 yrs. or older, passing of GATB tests, high-school graduation necessary for some courses, tenth grade necessary for others
Drafting technology**, electronics technology**

Volusia County Community Junior College, Daytona Beach
Public. J. G. Green, pres.
Technician enrolment: 55
Accreditation: State Ed. Dept.
Admission: High-school graduation or equivalent
Electronics technology, mechanical design technology, electrical technology

GEORGIA

ALBANY AREA VOCATIONAL-TECHNICAL SCHOOL, 1800 South Slapdey Drive, Albany
Public. H. D. Waters, dir.
Total enrolment: 525
Technician enrolment: 52
Admission: High-school graduation or equivalent, satisfactory GATB score
Electronic data processing technology*, electrical technology**, electronics technology**, mechanical technology

ATHENS AREA VOCATIONAL TECHNICAL SCHOOL, 419 Pope St., Athens
Public. R. G. Shelnutt, dir.
Total enrolment: 740
Technician enrolment: 110
Admission: High-school graduation and satisfactory scores on US employment test
Electronics technology**

AUGUSTA AREA VOCATIONAL-TECHNICAL SCHOOL, 2025 Lumpkin Rd., Augusta
Public. G. Hardy, dir., B. Brewton, dir., evening school
Total enrolment: 400
Technician enrolment: 100
Accreditation: State Ed. Dept.
Admission: Interview by director and instructor, passing aptitude test
Automotive technology**, airconditioning and heating technology**, drafting technology**, electrical technology**, electronics technology**, chemical technology**

COLUMBUS AREA VOCATIONAL-TECHNICAL SCHOOL, 4460 River Road, Columbus
Public. J. M. Richardson, dir.
Total enrolment: 250
Technician enrolment: 40
Accreditation: State Ed. Dept.
Admission: High-school graduation, minimum of 1 yr. of math and 1 yr. of science, satisfactory score on general aptitude test battery
Electronics technology**, mechanical design technology**, mechanical technology**

COOSA VALLEY AREA VOCATIONAL-TECHNICAL SCHOOL, Rome
Public. M. Culberson, dir.
Total enrolment: 350
Technician enrolment: 82
Admission: High-school graduation, satisfactory score on aptitude and achievement tests
Drafting technology*, electrical technology, electronics technology, mechanical technology

DEKALB AREA TECHNICAL SCHOOL, 495 North Indian Creek Rd., Stone Mountain
Public. P. J. Lowery
Total enrolment: 600
Technician enrolment: 300
Accreditation: State Ed. Dept.
Admission: High-school graduation, acceptable scores on the GATB, prerequisite courses in math and science
Electronic data processing technology**, electrical technology**, electronics technology**, mechanical technology**, chemical technology**

MARIETTA-COBB AREA VOCATIONAL-TECHNICAL SCHOOL, 210 South Cobb Drive, Marietta
Public. G. W. Smith, dir.
Admission: High-school graduation, qualifying score on GATB
Electrical technology, automotive technology, airconditioning and heating technology, electronics technology, mechanical design technology, mechanical technology

MONROE AREA VOCATIONAL-TECHNICAL SCHOOL, Albany
Public. B. White, dir.
Total enrolment: 254
Technician enrolment: 26
Accreditation: State Ed. Dept.
Admission: High-school graduation or equivalent, passing of entrance examination
Electronics technology

MOULTRIE AREA VOCATIONAL-TECHNICAL SCHOOL, Moultrie
Public
Electronics Technology

MUSCOGEE AREA VOCATIONAL-TECHNICAL SCHOOL, Courtland Ave., Columbus
Public. J. H. Smith, dir.
Total enrolment: 105
Technician enrolment: 10
Accredition: State Ed. Dept.
Admission: High-school graduation, 18 yrs. or older
Electronics technology

NORTH GEORGIA TECHNICAL AND VOCATIONAL SCHOOL, Clarkesville
Public. H. O. Carlton
Total enrolment: 986
Technician enrolment: 171
Accreditation: State Ed. Dept.
Admission: High-school graduation, acceptable GATB scores
Electronics technology, machine design technology

SAVANNAH VOCATIONAL SCHOOL, 214 W. Bay Street, Savannah
Public. J. Lytjen, dir.
Total enrolment: 2,600
Technician enrolment: 150
Admission: High-school graduation or GEDT equivalent
Electronics technology**

SMITH-HUGHES VOCATIONAL SCHOOL, 232 Pryor Street, SW, Atlanta
Public. R. E. Hagen, supv.
Electronics technology, instrumentation, mechanical design technology

SOUTH GEORGIA TECHNICAL AND VOCATIONAL SCHOOL, Americus
Public. H. P. Odom, dir.
Total enrolment: 500
Technician enrolment: 200
Admission: High-school graduation or equivalent, 18 yrs. or older, personal interview
Aeronautical technology, automotive technology, electrical technology, electronics technology, mechanical technology, diesel technology

SOUTHERN TECHNICAL INSTITUTE, Clay Street, Marietta
Public. H. L. McClure, dir.
Total enrolment: 1,000
Technician enrolment: 1,000
Accreditation: SA
Admission: High-school graduation, with 3 units of math. and 2 units of science
Airconditioning engineering technology†, civil engineering technology†, electrical engineering technology (power and electronics options)†, industrial engineering technology†, mechanical engineering technology†, textile engineering technology, building construction technology†, gas engineering technology†

THOMAS AREA VOCATIONAL-TECHNICAL SCHOOL, Thomasville
Public. P. Sewell, dir.
Total enrolment: 99
Admission: High-school graduation, satisfactory score on GATB test, satisfactory rating by screening committee as a result of interview
Electronics technology

UPSON COUNTY AREA VOCATIONAL-TECHNICAL SCHOOL, Box 6, Thomaston
Public. E. G. McCants, dir.
Electronics technology

VALDOSTA AREA VOCATIONAL-TECHNICAL SCHOOL, Valdosta
Public. W. Harrison, dir.
Mechanical technology, electronics technology

WALTON AREA VOCATIONAL-TECHNICAL SCHOOL, Thomasville
Public. P. Sewell, dir.
Total enrolment: 40
Admission: High-school graduation, satis-

factory score on GATB test, satisfactory rating by screening committee as a result of interview
Electronics technology

Waycross Area Vocational-Technical School, Waycross
Public. R. Hartley, dir.
Electronics technology

HAWAII

Church College of Hawaii, Laie
Private. R. T. Wooton, pres.
Total enrolment: 900
Technician enrolment: 100
Accreditation: WA
Admission: High-school graduation
Automotive technology, electronics technology, industrial electronic technology, industrial technology*, metallurgical technology

Hawaii Technical School, P. O. Box 1457, Hilo
Public. H. Watanabe, prin.
Total enrolment: 300
Technician enrolment: 23
Accreditation: State Ed. Dept.
Admission: High-school graduation
Drafting technology, architectural drafting technology

Honolulu Technical School, 874 Dillingham Blvd., Honolulu
Public. J. W. Nothom, prin.
Total enrolment: 600
Technician enrolment: 105
Admission: High-school graduation, satisfactory school record, satisfactory test scores
Civil technology, architectural drafting technology, electronics technology

IDAHO

Idaho Falls School District No. 91, Idaho Falls
Public
Electronics technology*, production technology*

Kellogg School District No. 391, Kellogg
Public
Electronics technology*

Lewiston Independent School District No. 1, Lewiston
Public. A. L. Smith, supt.
Total enrolment: 5,500
Technician enrolment: 210
Accreditation: NWA
Automotive technology, electrical technology

Rigby School District No. 251, Rigby
Public
Civil and construction technology*

ILLINOIS

Allied Institute of Technology, 1338 South Michigan Ave., Chicago 5
Private. H. Lebeson, pres.
Total enrolment: 2,099
Technician enrolment: 895
Accreditation: State Ed. Dept.
Admission: Four years of high school or equivalent in industrial experience
Automotive technology*, airconditioning and heating technology**, drafting technology**, industrial technology**, drafting and tool design**, machine drafting and design**, machine tool technology, tool engineering, structural drafting and design, drafting and industrial electronics

Belleville Junior College, Belleville
Public. K. L. Edwards, dean
Accreditation: NCA, State Ed. Dept
Admission: High-school graduation
Architectural and civil technology, chemical technology, electrical technology, electronics technology, engineering technology, industrial technology

Black Hawk College, 1001 16th Street, Moline
Public. R. E. Whalen, pres.
Total enrolment: 1,706
Technician enrolment: 25
Accreditation: NCA
Admission: High-school graduation, GEDT
Electronics technology

Bloom Community College, Dixie Highway at 10th St., Chicago Heights
Public. A. Martin, dean
Total enrolment: 450
Technician enrolment: 45
Accreditation: State Ed. Dept.
Admission: High-school graduation
Electronics technology**

Canton Community College, 1001 North Main Street, Canton
Public. P. S. Osborn, dean
Total enrolment: 500
Technician enrolment: 15
Accreditation: State Ed. Dept.
Admission: High-school graduation
Architectural drafting technology*, machine tool technology*

Central YMCA Junior College, 19 South LaSalle Street, Chicago 3
Private. D. A. Canar, exec. dean
Total enrolment: 2,000
Technician enrolment: 50
Accreditation: State Ed. Dept.
Admission: High-school graduation or pass GED exams
Electronic data processing technology

Chicago City Junior College, Bogan Branch, 3939 W. 79th Street, Chicago
Public. H. C. Klopp, asst. dean
Chemical technology

Chicago City Junior College, Fenger Branch, 11220 S. Wallace, Chicago
Public. H. C. Klopp, asst. dean
Chemical technology, engineering technology

Chicago City Junior College, Loop Branch, Chicago
Public. E. Clements, dean
Total enrolment: 2,500
Technician enrolment: 125
Accreditation: NCA
Admission: Graduation from accredited high school
Electronic data processing technology

Chicago City Junior College, Southeast Branch, 2100 E. 87th St., Chicago
Public. J. F. Grede, dean; C. Pachucki, dir., tech. progms.
Total enrolment: 2,500
Technician enrolment: 244
Accreditation: NCA
Admission: High-school graduation with ability in science and math
Electronics technology, industrial chemical technology, instrumentation

Chicago City Junior College, Wright Branch, 3400 N. Austin Ave., Chicago
Public. O. E. Shabat, dean
Total enrolment: 8,118
Technician enrolment: 41
Accreditation: NCA
Admission: High-school graduation or 21 yrs. or older
Drafting technology, architectural drafting technology, electronics technology, drafting and tool design, machine drafting and design, mechanical design technology, fundamental strength of metals and design

Chicago Technical College, 2000 South Michigan Avenue, Chicago 16
Private. L. G. Morey, pres.
Total enrolment: 1,200
Technician enrolment: 300
Accreditation: State Ed. Dept.
Admission: High-school graduation with credits in math, science, and mechanical drawing
Civil technology, electrical technology, architectural technology, mechanical technology

Community High School, District 123, North Chicago
Public. W. Snodgrass, supv.
Total enrolment: 1,125
Accreditation: State Ed. Dept.
Electronic data processing technology*, drafting technology*, electronics technology*, industrial electronic technology*, computer programing*

Danville Junior College, Jackson and Fairchild, Danville
Public. M. Miller, dean; M. W. Milgate, dir., tech. ed.
Total enrolment: 500
Technician enrolment: 40
Accreditation: NCA
Admission: High-school graduation or equivalent with a minimum of two yrs. high-school mathematics
Electronic data processing technology**, mechanical design technology

Decatur Public Schools, 101 West Cerro Gordo, Decatur
Public. P. V. McMorris, dir.
Total enrolment: 4,743
Technician enrolment: 48
Accreditation: NCA
Admission: High-school graduation with two yrs. of high-school math
Electronic data processing technology, electronics technology

DeVry Technical Institute, 4141 Belmont Avenue, Chicago 41
Private
Electronic technology and design†

Dunbar Vocational High School, 3000 South Park Way, Chicago 16
Public. J. J. Dixon, prin.
Total enrolment: 2,165
Technician enrolment: 11
Accreditation: NCA
Admission: High-school graduation with 1 yr. physics, 2 yrs. drafting, 2½ yrs. math
Aviation electronic technology

East Alton-Wood River Area Technical Institute, 777 N. Wood River Ave., Wood River
Public. W. G. Stevenson, dir.
Total enrolment: 1,460
Technician enrolment: 11
Accreditation: NCA, State Ed. Dept.
Admission: High-school graduation or equivalent with basic math and science background
Industrial electronic technology

Freeport Community College, West Moseley St., Freeport
Public. E. F. Hargett, dean
Total enrolment: 300
Accreditation: State Ed. Dept.
Admission: Graduation from accredited high school or equivalent, 2 yrs. math
Drafting technology*, electronics technology, mechanical design technology, mechanical technology, engineering economics*

Institute of Aviation, University of Illinois, 318 Civil Engineering Hall, Urbana
Public. L. A. Bryan, dir.
Total enrolment: 100
Technician enrolment: 15
Accreditation: NCA
Admission: High-school graduation with 3½ units of math
Aviation electronic technology

Joliet Junior College, 201 East Jefferson Street, Joliet
Public. E. H. Frost, dir.
Total enrolment: 1,250
Technician enrolment: 120
Accreditation: NCA
Admission: High-school diploma or GED test or over 21 yrs.
Automotive technology, airconditioning and heating technology*, electronic data processing technology*, drafting technology, electrical technology**, electronics technology*, drafting and tool design, mechanical design technology, printing technology

LaSalle-Peru-Oglesby Junior College, Fifth and Chartres Street, LaSalle
Public. F. H. Dolan, supt.
Total enrolment: 351
Technician enrolment: 57
Accreditation: NCA
Admission: High-school graduation, upper half of graduating class, and strong interest in technical field
Electronic data processing technology, electronics technology

Lewis Technical Institute, Lockport
Private. L. Paul, pres.
Total enrolment: 720
Technician enrolment: 70
Admission: High-school graduation
Aeronautical technology

Morton Junior College, 2423 South Austin Blvd., Cicero
Public. H. J. White, dean
Total enrolment: 1,810
Technician enrolment: 31
Accreditation: NCA
Admission: High-school graduation with 2 yrs. of math
Electronics technology, data processing

Peoria College of Bradley University, Peoria
Private. W. W. Grimm, dean
Total enrolment: 206
Technician enrolment: 73
Accreditation: NCA
Admission: Accepted high-school record, satisfactory SATB scores, 2 units high-school math and 2 units high-school science
Automotive technology, electronics technology, building construction technology, machine design technology, metal technology, wood technology

Rockford Technical Institute, 201 S. Madison St., Rockford
Public. J. E. Fortin, dir.
Total enrolment: 260
Technician enrolment: 260
Accreditation: State Ed. Dept.
Admission: High-school graduation or equivalent with 2 yrs. of math
Airconditioning and heating technology*, electronic data processing technology**, drafting technology*, industrial technology*, drafting and tool design*, machine drafting and design*, machine tool technology*, metallurgical technology*

Southern Illinois University, Vocational Technical Institute, Carbondale
Public. E. J. Simon, dean
Total enrolment: 800
Technician enrolment: 407
Accreditation: NCA
Admission: Graduation from accredited high school or pass GED test
Automotive technology, aeronautical technology, electronic data processing technology, architectural drafting technology, electronics technology, machine drafting and design, machine tool technology, printing and photo engraving technology, building construction technology, woodworking technology

Sterling Township High School, 1608 4th Avenue, Sterling
Public. J. J. Watts, dir., ind. ed.
Total enrolment: 1,300
Accreditation: NCA
Admission: High-school graduation with 2½ yrs. of math and 1 yr. of physical science
Mechanical technology

Thornton Junior College, 151st and Broadway, Harvey
Public. H. D. Roberts, dir.
Total enrolment: 676
Technician enrolment: 107
Accreditation: NCA
Admission: High-school graduation or satisfactory test scores on GED tests
Industrial electronic technology, drafting and tool design, mechanical design technology

UNITED TOWNSHIP TECHNICAL INSTITUTE, 1420 18th Avenue, East Moline
Public. L. F. Vines, dir., ind. and tech. ed.
Total enrolment: 60
Accreditation: State Ed. Dept.
Admission: High-school graduation or equivalent
Industrial electronic technology**

WABASH VALLEY COLLEGE, Mt. Carmel
Public. C. Edwin Pearson, dean
Total enrolment: 284
Technician enrolment: 26
Accreditation: State Ed. Dept.
Admission: High-school graduation, in upper ⅓ of graduating class and completed 2 units of math and 1 unit of science
Electronics technology

WAUKEGAN TOWNSHIP HIGH SCHOOL, 1011 W. Washington Ave., Waukegan
Public. A. O. Remde, dir.
Technician enrolment: 108
Accreditation: NCA
Admission: High-school graduation or equivalent, 18 yrs. or older, 1 yr. high-school math and 1 yr. high-school physical science
Electronic data processing technology, electronics technology, chemical technology, general engineering technology

INDIANA

BEDFORD HIGH SCHOOL, Bedford
Public
Electronics technology*

BLOOMINGTON METROPOLITAN SCHOOLS, 441 S. College, Bloomington
Public. C. G. Taylor, asst. adm.
Total enrolment: 175
Technician enrolment: 135
Accreditation: NCA
Admission: High-school graduation
Electronics technology, industrial technology

CENTRAL HIGH SCHOOL, 110 N. Williams St., South Bend
Public
Mechanical technology*

FORT WAYNE COMMUNITY SCHOOL, Fort Wayne
Public. J. Bobay, voc. dir.
Total enrolment: 5,149
Technician enrolment: 900
Accreditation: State Ed. Dept.
Admission: Ability to profit from the instruction
Airconditioning and heating technology*, drafting technology*, electrical technology*, electromechanical technology*, electronics technology*, industrial electronic technology*, drafting and tool design*, machine drafting and design*, machine tool technology*, mechanical design technology*, mechanical technology*, printing and photoengraving technology*

HOWARD SAMS TECHNICAL INSTITUTE, 4300 West 62nd Street, Indianapolis, 6
Private. M. Parks, Jr., v.-p. in charge
Admission: Varies according to course
Electronics technology, industrial electronic technology, industrial technology, drafting and tool design, machine drafting and design, machine tool technology, mechanical design technology

LAIN TECHNICAL INSTITUTE, 601 North Delaware St., Indianapolis; and 820 Division St., Evansville
Private. W. C. Monteith, dean
Total enrolment: 250
Technician enrolment: 250
Admission: High-school graduation and satisfactory completion of entrance tests
Architectural engineering technology, industrial engineering technology, tool and design technology

LULU CLINE SCHOOL, South Bend
Public
Electronics technology*

SOUTH BEND VOCATIONAL SCHOOL, South Bend
Public
Electronics technology*

VALPARAISO TECHNICAL INSTITUTE, Valparaiso
Public. E. Hershman, pres.
Total enrolment: 325
Technician enrolment: 325
Admission: High-school graduation, 1 yr. math, upper ¾ graduating class
Electronics technology, electronic engineering technology†

VIGO COUNTY SCHOOL CORPORATION, Voc.-Tech. Adult Ed. Center, Terre Haute
Public
Electrical technology*, electronics technology*, mechanical technology*

VINCENNES UNIVERSITY, Vincennes
Public. J. H. Hill, dean
Total enrolment: 661
Technician enrolment: 26
Electronics technology, electrical technology, drafting technology, electronic data processing technology

WASHINGTON HIGH SCHOOL, 4747 W. Washington St., South Bend
Public. R. C. Riley, prin.
Technician enrolment: 400
Admission: High-school graduation
Automotive technology*, civil and construction technology*, drafting technology*, architectural drafting technology*, electrical technology*, electronics technology*, industrial electronic technology*, industrial technology*, drafting and tool design*, machine drafting and design*, machine tool technology*, mechanical design technology*, metallurgical technology*

IOWA

BURLINGTON COMMUNITY COLLEGE, 1308 Valley St., Burlington
Public. R. A. St. Clair, dir.
Total enrolment: 450
Technician enrolment: 60
Accreditation: NCA
Admission: High-school graduation or equivalent
Electronics technology, mechanical design technology, mechanical production technology

CEDAR RAPIDS COMMUNITY SCHOOL, Board of Education, 346 Second Avenue, SW, Cedar Rapids
Public. A. Salisbury, supt.
Accreditation: State Ed. Dept.
Admission: High-school graduation or equivalent, test battery
Data processing

CENTERVILLE COMMUNITY COLLEGE, Centerville
Public. L. Hellyer, dean
Total enrolment: 275
Technician enrolment: 57
Accreditation: State Ed. Dept.
Admission: High-school graduation
Automotive technology, electronics technology

CLARINDA COMMUNITY COLLEGE, Clarinda
Public. L. J. Sonneman, dean
Total enrolment: 218
Technician enrolment: 13
Accreditation: Iowa State U.
Admission: High-school graduation
Drafting and tool design, machine drafting and design**, machine tool technology**, mechanical design technology, mechanical technology

CLINTON JUNIOR COLLEGE, Clinton
Public. P. B. Sharar
Total enrolment: 245
Accreditation: State Ed. Dept.
Admission: 1½ yrs. of algebra
Electronics technology

DAVENPORT AREA TECHNICAL SCHOOL, 1001 Harrison St., Davenport

Public. A. M. Sarchett, dir.
Technician enrolment: 93
Accreditation: State Ed. Dept.
Admission: High-school graduation or equivalent, upper ½ of class
Electronics technology, mechanical technology

Des Moines Community School, 1800 Grand Ave., Des Moines
Public. J. Bell, dir.
Total enrolment: 2,048
Technician enrolment: 190
Accreditation: NCA
Airconditioning and heating technology, electronic data processing technology, industrial electronic technology, machine drafting and design, communications electronics

Eagle Grove Junior College, Eagle Grove
Mechanical technology

Iowa State University, Technical Institute, Ames
Public. H. B. Ellis, head, tech. inst.
Technician enrolment: 283
Accreditation: NCA
Admission: High-school graduation from approved school with units of algebra, geometry, physics, and chemistry recommended
Construction technology, electronics technology**, mechanical technology, chemical industries technology

Iowa Technical Education Center, 226 South Benton, Ottumwa
Public. H. L. Norris, dir.
Total enrolment: 125
Technician enrolment: 125
Accreditation: State Ed. Dept.
Admission: High-school graduation or equivalent
Electronic data processing technology, electronics technology

Mason City Community College, Mason City
Public. C. Beem, Dean
Total enrolment: 850
Technician enrolment: 96
Accreditation: NCA
Admission: High-school graduation or equivalent
Drafting technology**, electronics technology**

Sioux City Board of Education, 1221 Pierce St., Sioux City
Public. C. E. Zink, dir.
Technician enrolment: 60
Accreditation: State Ed. Dept.
Admission: High-school graduation or equivalent
Drafting technology, automotive technology*, electrical technology, electronics technology*, industrial technology*

Waterloo Independent School District, 421 Vine Street, Waterloo
Public. D. L. Lippold, dir.
Technician enrolment: 48
Accreditation: State Ed. Dept.
Admission: High-school graduation or equivalent
Electronics technology**, mechanical technology

KANSAS

Campus High School, 2100 W. 55th Street, S., Wichita 17
Public. D. Ferguson, supt.
Total enrolment: 1,250
Technician enrolment: 40
Accreditation: State Ed. Dept.
Electronic data processing technology**

Garden City Junior College, Garden City
Public. L. Hood, supt.
Mechanical technology

Hutchinson Junior College, 1300 North Plum, Hutchinson
Public. G. W. Koon, dir.
Total enrolment: 1,030
Technician enrolment: 250
Accreditation: NCA
Admission: Satisfactory ACT and GATB scores
Automotive technology**, electronic data processing*, drafting technology**, electrical technology**, electronics technology**, drafting and tool design**, mechanical technology**

Independence Community College, 10th and Oak Street, Independence
Public. F. Cinotto, dean
Total enrolment: 431
Technician enrolment: 35
Accreditation: NCA, State Ed. Dept.
Admission: High-school graduation
Drafting technology, electronics technology

Kansas City Kansas Junior College, Kansas City
Public. C. W. Harvey, dean
Total enrolment: 751
Accreditation: NCA and State Ed. Dept.
Admission: High-school graduation or successful scores on battery of tests
Engineering technology

Kansas State College of Pittsburg, Vocational-Technical Training Department, Pittsburg
Public. L. D. Boone, dir., voc.-tech. trng. dept.
Total enrolment: 320
Technician enrolment: 40
Accreditation: State Ed. Dept.
Admission: High-school graduation or equivalent and entrance exam
Drafting technology

Labette County Community High School, Altamont
Public. H. F. Harrison, supt.
Total enrolment: 828
Technician enrolment: 93
Admission: High-school graduation
Electronics technology

McFarland Trade School, Coffeyville
Public. W. F. Currier, dir.
Total enrolment: 454
Technician enrolment: 39
Accreditation: State Ed. Dept.
Admission: Aptitude tests
Electronics technology

Olathe Public Schools, Olathe
Public. W. Fick, supt.
Total enrolment: 3,000
Technician enrolment: 75
Accreditation: NCA, State Ed. Dept.
Electronic data processing technology, automotive technology, industrial technology

Parsons Junior College, Parsons
Public. C. H. Thieband
Total enrolment: 318
Technician enrolment: 38
Accreditation: State Ed. Dept.
Admission: High-school graduation or equivalent
Automotive technology, drafting technology, printing technology

University of Kansas, Extension, Lawrence
Public. H. T. Walker, dir.
Total enrolment: 11,250
Technician enrolment: 816
Accreditation: NCA
Drafting technology*, electrical technology*, electromechanical technology*, industrial electronic technology*, industrial technology*, machine drafting and design*, technical writing*, data processing*, electronics technology*

Wichita Public Schools, 640 N. Emporia, Wichita
Public. G. T. Butts, dir., tech. ed.
Technician enrolment: 116
Accreditation: State Ed. Dept.
Drafting technology, electrical technology

KENTUCKY

Ashland Area Vocational School, 41st and Winchester Avenue, Ashland
Public
Electronics technology**, mechanical technology*

Hazard Area Vocational School,
645 N. Main Street, Hazard
Public. W. Prater, dir.
Total enrolment: 300
Technician enrolment: 120
Accreditation: State Ed. Dept.
Automotive technology**, drafting technology**, electronics technology**, heavy equipment technology

Lexington Vocational School,
Springfield Drive, Lexington
Public. C. W. Howard, dir.
Electronics technology, drafting and tool design

Mayo State Vocational School,
Paintsville
Public. G. L. Ramey, dir.
Electronics technology**

Owensboro Area Vocational School,
1501 Frederica Street, Owensboro
Public
Total enrolment: 700
Technician enrolment: 90
Admission: 16 yrs. old, satisfactory GATB score
Industrial electronic technology, metallurgical technology, electronics technology**

Somerset Vocational School, N. College Street, Somerset
Public. H. D. Noe, dir.
Electronics technology**

United Electronics Institute,
3947 Park Drive, Louisville
Private. W. L. Rector, pres.
Total enrolment: 6,796
Technician enrolment: 6,796
Electronics technology**

Western Trade School, P. O. Box 278, College Heights, Bowling Green
Public. P. C. Hampton, dir.
Total enrolment: 375
Technician enrolment: 26
Admission: Desire and ability to learn the subject matter
Electronics technology**

LOUISIANA

Avoyelles Vo-Technical Institute,
Cottonport
Public. J. W. Gaspard, dir.
Total enrolment: 1,061
Technician enrolment: 34
Accreditation: State Ed. Dept.
Electronics technology**

Baton Rouge Voc-Tech School, 3400 Winbourne Ave., Baton Rouge
Public. J. Bowling, Jr., dir.
Total enrolment: 2,553
Technician enrolment: 241
Electronics technology, refrigeration-airconditioning technology

Capitol Area Vocational School,
P. O. Box 2012, Baton Rouge
Public. E. Harris, dir.
Total enrolment: 238
Technician enrolment: 22
Electronic communications technology**

Central Area Trade School, 415 Lec St., Natchitoches
Public. C. L. Cross, dir.
Total enrolment: 361
Technician enrolment: 30
Electronics communications technology

Concordia Parish Trade School, P. O. Box 152, Ferriday
Public. M. W. Beasley, dir.
Total enrolment: 323
Technician enrolment: 37
Electronics communications technology

Delgado Trades and Technical Institute, 615 City Park Ave., New Orleans
Public. Marvin Thames, pres.
Electronics technology, refrigeration and airconditioning technology, industrial chemistry, data processing

Delta Area Vocational School, P. O. Box 1321, Monroe
Public. G. W. Muse, dir.
Total enrolment: 83
Technician enrolment: 14
Admission: Able to profit from the instruction and training
Electronics technology

Gulf Area Vocational School, P. O. Box 541, Abbeville
Public. W. W. Finuf, Jr., dir.
Total enrolment: 1,030
Technician enrolment: 63
Electronics communications technology

Iberia Trades School, P. O. Box 230, New Iberia
Public. M. N. Miley, dir.
Total enrolment: 1,036
Technician enrolment: 117
Electronic communications technology

Jefferson Davis Vocational-Technical School, Elizabeth
Public
Electronics technology*

Jefferson Parish Trade School, 32 First St., Gretna
Public. R. W. Bentley, Jr., dir.
Total enrolment: 1,673
Technician enrolment: 185
Industrial electronic technology

Memorial Area Vocational School,
337 Napoleon St., New Roads
Public. B. J. Brumfield, dir.
Total enrolment: 698
Technician enrolment: 45
Electronic communications technology

North Central Area Vocational-Technical School, P. O. Box 548, Farmerville
Public. C. C. Ferguson, dir.
Total enrolment: 234
Technician enrolment: 24
Electronic communications technology

Northeast Louisiana Vocational School, P. O. Box 672, Winnsboro
Public. P. R. Purser, dir.
Total enrolment: 407
Technician enrolment: 33
Electronic communications technology

Northwest Louisiana Vocational-Technical School, P.O. Box 804, Minden
Public. J. E. Oswalt, dir.
Total enrolment: 759
Technician enrolment: 72
Accreditation: State Ed. Dept.
Admission: High-school graduation
Electronics technology**, industrial instruments service and repair technology**

Orleans Area Vocational-Technical School, P. O. Box 8202, New Orleans 22
Public. S. W. Collier, dir.
Total enrolment: 463
Technician enrolment: 76
Electronic communications technology

Ouachita Valley Vocational-Technical School, P. O. Box 546, West Monroe
Public. S. W. Jackson, dir.
Total enrolment: 2,147
Technician enrolment: 267
Accreditation: State Ed. Dept.
Admission: A good background in math and science, and be able to pass the standardized achievement test program
Airconditioning technology**, civil technology**, electrical technology**, industrial electronic technology**, electronic communications technology**

Shreveport Trade School, 837 Hope St., Shreveport 13
Public. J. W. Moore, dir.
Total enrolment: 1,211
Technician enrolment: 100
Industrial electronic technology, refrigeration and airconditioning technology

South Louisiana Trade School, P. O. Box 1330, Houma

Public. H. P. Willis, dir.
Total enrolment: 1,161
Technician enrolment: 167
Electronic communications technology, mechanical drafting and design technology

Southwest Louisiana Vocational-Technical School, Crowley
Public. J. W. Mitchell, dir.
Total enrolment: 623
Technician enrolment: 134
Electronic communications technology, industrial electronic technology, mechanical drafting and design technology

Sowela Technical Institute, 401 Broad St., Lake Charles
Public. R. H. Smelser, dir.
Total enrolment: 594
Technician enrolment: 122
Accreditation: State Ed. Dept.
Admission: High-school graduation, pass entrance tests
Automotive technology**, civil technology**, civil and construction technology**, electronic data processing technology**, drafting technology**, architectural drafting technology**, electrical technology**, electronics technology**, industrial electronic technology**, industrial technology, gas fuels technology, power mechanics technology**

T. H. Harris Vocational-Technical School, Eunice
Public
Mechanical technology*

T. H. Harris Vocational-Technical School, 358 E. Laurent St., Opelousas
Public. G. Madlene, dir.
Total enrolment: 1,039
Technician enrolment: 76
Industrial electronic technology, civil technology, mechanical technology*, electronics technology*

T. H. Harris Vocational-Technical School, Ville Platte
Electronics technology*

MAINE

Lewiston High School, Lewiston
Public. A. W. Lessard, supv.
Electronics technology*

Maine Vocational Technical Institute, Fort Road, South Portland
Public. E. Hutchinson, prin.
Total enrolment: 378
Technician enrolment: 86
Accreditation: State Ed. Dept.
Admission: High-school graduation with 2 yrs. algebra, geometry, and physics
Electronics technology*, industrial electrical technology

Searsport School Board, Searsport
Public
Electronics technology*

Westbrook High School, Westbrook
Public. C. B. Jensen, dir.
Production technology*

MARYLAND

Allegany Community College, 340 Frederick St., Cumberland
Public. R. S. Zimmer, pres.
Total enrolment: 218
Accreditation: State Ed. Dept.
Admission: High-school graduation. Maturity and course prerequisites
Chemical technology

Baltimore Junior College, 2901 Liberty Heights Ave., Baltimore 15
Public. H. Bard, pres.
Total enrolment: 1,991
Technician enrolment: 201
Accreditation: State Ed. Dept., MSA
Admission: High-school graduation or equivalent, satisfactory test scores
Electronics technology, construction technology, mechanical technology, laboratory technology

Baltimore Polytechnic Institute, North Avenue and Calvert St., Baltimore
Public. C. A. Burkett, prin.
Electronics technology, mechanical technology

Baltimore School No. 409, Baltimore
Public
Civil and construction technology*, electronics technology*

Carver Vocational Technical High School, Presstman and Bentalou Street, Baltimore 16
Public. S. M. Perdue, prin.
Electronics technology

Catonsville Community College, Catonsville 28
Public. K. Stringer, acad. dean
Total enrolment: 414
Accreditation: State Ed. Dept.
Admission: High-school graduation with acceptable pattern of courses or equivalent
Electronics technology

Hagerstown Junior College, Hagerstown
Public. A. C. Kepler, pres.
Total enrolment: 550
Technician enrolment: 25
Accreditation: State Ed. Dept.
Admission: High-school graduation or equivalent
Engineering technology

Harford Community College, Bel Air
Public. J. W. Musselman, pres.
Total enrolment: 416
Technician enrolment: 41
Accreditation: State Ed. Dept.
Admission: High-school graduation or pass GED test
Electronics technology, drafting technology, electrical technology

Mergenthaler Vocational Technical High School, 35th St. and Hillen Rd., Baltimore
Public. G. E. Griefzer, prin.
Electrical technology, mechanical technology, tool design technology, electronics technology

Montgomery Junior College, Takoma Park 12
Public. D. E. Deyo, dean
Total enrolment: 2,367
Technician enrolment: 751
Accreditation: MSA
Admission: Residents, high-school graduation; non-residents, upper half of high-school graduating class
Electronic data processing technology, electrical technology, electronics technology, radiation technology

North Hagerstown High School, Hagerstown
Public. H. C. Logsden, prin.
Electronics technology

Richard Montgomery High School, Rockville
Public. E. Guy Jewell, prin.
Map-making technology

South Hagerstown High School, Hagerstown
Public. R. T. Whisner, prin.
Electronics technology, machine tool design technology

Wheaton High School, Dalewood and Randolph, Wheaton
Public. E. P. Moran, prin.
Electronics technology, drafting and design technology

Wicomico High School, Salisbury
Public. G. H. Corddry, Jr., prin.
Electronics technology

MASSACHUSETTS

Arlington Technical and Vocational High School, Massachusetts Ave., Arlington
Public. E. J. Lewis, dir.
Electronic data processing technology

Berkshire Community College, Second St., Pittsfield

Public. M. E. O'Connell, dir.
Total enrolment: 375
Technician enrolment: 55
Accreditation: State Ed. Dept.
Admission: High-school graduation with a promising record
Electrical technology

Fall River Area Vocational-Technical School, Fall River
Public. J. P. Harrington, dir.
Total enrolment: 375
Technician enrolment: 30
Accreditation: State Ed. Dept.
Electronics technology

Framingham Area Vocational-Technical School, Framingham
Public
Electronics technology*, production technology*

Franklin Institute of Boston, 41 Berkeley St., Boston 16
Public. L. J. Dunham, Jr., dir.
Total enrolment: 500
Technician enrolment: 400
Admission: High-school graduation, recommendation by high-school principal, 2 yrs. of math and 1 yr. of science
Automotive technology**, airconditioning and heating technology*, civil technology**†, civil and construction technology*, drafting technology*, architectural drafting technology*, electrical technology**†, electromechanical technology*, electronics technology**†, industrial electronic technology*, industrial technology*, drafting and tool design*, machine drafting and design*, machine tool technology*, mechanical design technology**†, mechanical technology**†, instrumentation*, chemical technology, applied electronics

Leominster Area Vocational-Technical School, Leominster
Public
Electronics technology*, mechanical technology*

Lowell Area Vocational-Technical School, Lowell
Public
Electronics technology*

Lowell Technological Institute, Division of Evening Studies, Lowell
Public. E. B. Van Dusen, dir., evening school
Total enrolment: 2,300
Technician enrolment: 1,800
Accreditation: NEA, State Ed. Dept.
Admission: High-school graduation, 1 yr. algebra, 1 yr. plane geometry
Chemical technology

Lynn Area Vocational-Technical School, Lynn
Public
Mechanical technology*

Massachusetts Bay Community College, 27 Garrison St., Boston
Public. J. F. McKenzie, dir.
Total enrolment: 676
Accreditation: State Bd. of Collegiate Authority
Admission: High-school graduation
Electrical technology, electronics technology

Massachusetts Trades Shops School, 161 High School, Boston
Public. J. B. Gouse, dir.
Total enrolment: 1,000
Accreditation: State Ed. Dept.
Admission: Passing of qualification test
Drafting and tool design**, machine drafting and design**, electronics technology**, electronic drafting

Medford Area Vocational-Technical School, Medford
Public
Electronics*

Modern Technical School, 899 Boylston St., Boston
Private. B. V. Phinney, dir.
Total enrolment: 100
Technician enrolment: 75
Accreditation: State Ed. Dept.
Admission: High-school graduation or equivalent
Drafting technology*, electromechanical technology*, drafting and tool design*, machine drafting and design*

New Bedford Area Vocational-Technical School, New Bedford
Public
Electronics technology*

Newton Area Vocational-Technical School, Newton
Public
Electronics technology**, mechanical technology, production technology*

Newton Junior College, Washington Park at Walnut Street, Newtonville
Public. C. W. Dudley, dir.
Total enrolment: 485
Accreditation: State Ed. Dept.
Admission: High-school graduation, SATS, personal interview
Business data processing technology, electronics technology

Northeast Institute of Industrial Technology, 41 Phillips St., Beacon Hill, Boston
Private. J. W. Hoffman, pres.
Total enrolment: 700
Technician enrolment: 700
Accreditation: State Ed. Dept., Mass. Bd. Collegiate Authority
Airconditioning and heating technology**, drafting technology**, architectural drafting technology**, electronics technology**, industrial electronic technology**, drafting and tool design**, machine drafting and design**, mechanical design technology**, instrumentation**

Northern Essex Community College, Chadwick St., Haverhill
Public. H. Bentley, dir.
Total enrolment: 400
Technician enrolment: 40
Accreditation: State Ed. Dept.
Admission: High-school graduation, SAT, at least 3 yrs. math
Electronics technology

Pittsfield Area Vocational-Technical School, Pittsfield
Public
Electronics technology**

Quincy Area Vocational-Technical School, Quincy
Public
Electronics technology*

Wentworth Institute, 550 Huntington Ave., Boston 15
Private. E. B. Van Dusen, dean of instr.
Total enrolment: 3,283
Accreditation: Mass. Bd. Collegiate Authority
Admission: High-school graduation and prescribed courses
Aircraft maintenance technology†, architectural engineering technology†, building construction technology†, civil and highway engineering technology†, electronic engineering technology†, electrical engineering technology†, mechanical engineering technology (heat power and design options)†, mechanical technology (machine processes and design options)†, metals engineering technology†, production engineering technology†

Worcester Area Vocational-Technical School, Worcester
Public. O. A. Maynard, coord.
Total enrolment: 250
Technician enrolment: 125
Admission: High-school graduation, 1 yr. algebra, 1 yr. geometry, 1 yr. physics, and 1 yr. mechanical drawing
Chemical and metallurgical technology**, industrial electronic technology, machine tool technology, mechanical technology

MICHIGAN

Alma High School, 520 Liberty St., Alma
Public
Chemical and metallurgical technology*

Alpena Community College, 666 Johnson St., Alpena
Public. S. E. Van Lane, dir.
Total enrolment: 500
Technician enrolment: 125
Accreditation: NCA
Admission: High-school graduation
Drafting technology, electrical technology, electronics technology, industrial technology, drafting and tool design, machine drafting and design, machine tool technology, metallurgical technology

Arthur Hill Technical High School, 512 S. Michigan Ave., Saginaw
Public. H. Chapman, prin.
Technician enrolment: 296
Accreditation: State Ed. Dept.
Electrical technology, electronics technology, mechanical drafting and design, mechanical production technology

Bay City Public Schools, 1800 Columbus Ave., Bay City
Public. H. J. Van Wezel, dir., voc. ed.
Technician enrolment: 470
Chemical technology, electrical technology, electronics technology, mechanical drafting and design, mechanical production technology, civil and construction technology

Benton Harbor Community College and Technical Institute, 750 Britain Ave., Benton Harbor
Public. R. Lahti, pres.
Total enrolment: 800
Technician enrolment: 125
Accreditation: NCA
Admission: High-school diploma
Drafting technology, electrical technology, electronics technology, industrial technology, mechanical technology

Cass Apprentice School, 2421 Second Ave., Detroit
Public. O. F. Heft, prin.
Total enrolment: 1,400
Technician enrolment: 908
Accreditation: Bureau of Apprenticeship and Training
Admission: High-school graduation
Airconditioning and heating technology*, drafting technology*, electrical technology*, industrial electronic technology*, industrial technology*, drafting and tool design*, machine drafting and design*, machine tool technology*

Delta College, University Center
Public. G. O. Pease, dir., tech. div.
Total enrolment: 2,500
Technician enrolment: 135
Accreditation: State Ed. Dept.
Admission: High-school graduation, various curriculums have special requirements
Architectural drafting technology, electrical technology, electronics technology, mechanical technology, chemical technology

Detroit Engineering Institute, 2030 Grand River Ave., Detroit
Private. F. E. Lamb, dir.
Technician enrolment: 200
Accreditation: State Ed. Dept.
Admission: High-school graduation
Drafting technology

East Detroit High School, 15501 Couzens, East Detroit
Public. C. Grieg, prin.
Technician enrolment: 86
Electrical technology, electronics technology

Ferris State College, Big Rapids
Public. F. Swan, dean, coll. tech. div.
Total enrolment: 4,700
Technician enrolment: 1,325
Accreditation: NCA
Admission: High-school graduation or equivalent, native ability and sufficient aptitude
Automotive technology, airconditioning and heating technology, civil technology, electronic data processing technology, architectural drafting technology, industrial technology, machine drafting and design, machine tool technology, printing and photoengraving technology, industrial chemistry technology, technical illustration

Fitzgerald Public Schools, 23200 Ryan Road, Warren
Public. W. Fensch, prin.
Technician enrolment: 12
Electronics technology

Flint Community Junior College, 1401 E. Court St., Flint
Public. L. Fibel, dean
Total enrolment: 4,876
Technician enrolment: 243
Accredited: State Ed. Dept., NCA
Admission: High-school graduation with satisfactory preparation in English, math, and drafting
Electrical technology**, automotive technology**, mechanical technology**

Gladstone High School, Gladstone
Public
Chemical and metallurgical technology*

Gogebic Community College, Ironwood
Public. J. A. Solin, dir.
Total enrolment: 289
Technician enrolment: 10
Accreditation: NCA
Admission: High-school graduation or equivalent
Industrial technology

Grand Rapids Junior College, 143 Bostwich Ave., NE, Grand Rapids
Public. D. Fink, dean
Total enrolment: 2,200
Technician enrolment: 129
Accreditation: NCA, State Ed. Dept.
Admission: High-school graduation or over 21 yrs. old
Civil technology, electronic data processing technology, drafting technology, architectural drafting technology, electronics technology*, mechanical technology, chemical technology

Henry Ford Community College, 5101 Evergreen Road, Dearborn
Public. F. K. Eshleman, dean
Total enrolment: 7,200
Technician enrolment: 144
Accreditation: NCA
Admission: High-school graduation
Automotive technology, airconditioning and heating technology*, civil and construction technology*, electronic data processing technology*, drafting technology, electrical technology, electronics technology, industrial electronic technology*, drafting and tool design*, machine drafting and design*, machine tool technology*, mechanical design technology, mechanical technology*, metallurgical technology, instrumentation*

Highland Park College, Highland Park 3
Public. G. O. Withey, dean
Total enrolment: 2,000
Accreditation: NCA
Admission: High-school graduation and upper half of graduating class
Drafting technology

Jackson Junior College, 512 Wildwood Ave., Jackson
Public. W. N. Atkinson, pres.
Total enrolment: 1,515
Technician enrolment: 111
Accreditation: NCA
Admission: High-school graduation or equivalent
Electrical technology**, electronics technology, industrial electronic technology*, industrial technology**, drafting and tool design*, metallurgical technology*

Kalamazoo High School, Kalamazoo
Public
Chemical and metallurgical technology*

Kellogg Community College, North Ave., Battle Creek
Public. L. Billingsley, dir.
Total enrolment: 1,080
Technician enrolment: 119
Accreditation: State Ed. Dept.
Admission: High-school graduation for day program, desire to learn and related experience for night program
Drafting technology, electronics technology, industrial technology, drafting and tool design, mechanical technology

Lakeview High School, 21100 Eleven Mile Road, St. Clair Shores
Public. R. H. Schaublin, prin.
Total enrolment: 1,300
Technician enrolment: 300
Accreditation: NCA
Electronics technology, industrial electronic technology, machine drafting and design

Lansing Community College, 419 N. Capitol Ave., Lansing
Public. P. J. Gannon, dean
Total enrolment: 2,376
Technician enrolment: 202
Civil and highway technology, electronics technology**, civil technology**, civil and construction technology**, electronic data processing**, drafting technology**, architectural drafting technology**, electrical technology**, industrial electrical technology**, drafting and tool design**, mechanical technology**, chemical technology**

Lawrence Institute of Technology, 21000 W. Ten Mile Road, Southfield
Private. A. D. Hart, dir.
Technician enrolment: 1,050
Admission: High-school graduation and satisfactory scores on entrance tests
Electrical technology, industrial electronic technology, industrial technology, mechanical technology, building construction technology

The Michigan College of Mining and Technology, Houghton
Public. J. R. Van Pelt, pres.
Total enrolment: 2,750
Technician enrolment: 207
Accreditation: NCA
Admission: High-school graduation with units in algebra, plane geometry, physics
Drafting technology*, electrical technology*, electronic technology*, mechanical technology*

Monroe High School, Monroe
Public. D. M. Selby, dir.
Total enrolment: 1,800
Technician enrolment: 150
Accreditation: NCA
Electronics technology, drafting and tool design, machine tool technology, printing and photoengraving technology

Muskegon Community College, Muskegon
Public. J. M. Snyder, dir.
Total enrolment: 2,398
Accreditation: NCA
Admission: High-school graduation or 18 yrs. old
Electrical technology, electronics technology, mechanical production technology, automotive technology, mechanical drafting and design

Pontiac Central High School, 250 W. Huron St., Pontiac
Public. F. W. Staley, prin.
Technician enrolment: 111
Electrical technology, mechanical drafting and design, mechanical production, drafting technology, electrical technology, electronics technology, industrial technology

Port Huron Junior College, Port Huron
Public. J. C. Browning, dean
Total enrolment: 2,116
Technician enrolment: 73
Accreditation: NCA
Admission: Graduation from an accredited high school
Electronics technology, mechanical drafting and design, metallurgical technology, industrial technology

R.E.T.S. Electronics Schools, Intl. Headquarters, 1625 E. Grand Blvd., Detroit 11 (also schools in Flint and Grand Rapids, Mich., schools in Ohio, Mass., N.J., Pa., Md., Fla., Ind., Ill., and Calif.)
Private. M. Alyea, dir.
Total enrolment (Detroit only): 1,635
Technician enrolment (Detroit only) 1,635
Accreditation: State Ed. Depts. in Mich., Ohio, Mass., N.J., Pa., Md., Ind., Ill., and Calif.
Admission: High-school graduation or equivalent
Practical electronics and communications engineering, industrial electronics, electronics technology

St. Clair Shores Adult Education, 25901 Jefferson Avenue, St. Clair Shores
Public. R. Chenoweth, dir.
Total enrolment: 9,265
Technician enrolment: 84
Accreditation: NCA, State Ed. Dept.
Admission: None for adults or out-of-school youth
Automotive technology*, civil and construction technology*, drafting technology*, architectural drafting technology*, electrical technology*, electronics technology*, industrial electronic technology*, industrial technology*, drafting and tool design*, machine drafting and design*, mechanical design technology*, printing and photoengraving technology*, hydraulics technology*, welding technology*

Saginaw High School, Saginaw
Public
Electrical technology*, instrumentation, mechanical technology*

South Macomb Community College, 22900 Federal Ave., Warren
Public. W. E. Bradley
Chemical and metallurgical technology*

Technical School of Metallurgy, 13550 Auburn Ave., Detroit 23
Private. C. A. Nagler, dir.
Accreditation: State Ed. Dept.
Metallurgical technology

Western Michigan University, Kalamazoo
Public. George Kohrman, dean
Total enrolment: 12,000
Technician enrolment: 140
Accreditation: NCA
Admission: High-school graduation with at least "C" average
Automotive technology, aeronautical technology, electronic technology, drafting and tool design

MINNESOTA

Austin Area Vocational-Technical School, Austin
Public. M. A. Carney, dir.
Total enrolment: 275
Technician enrolment: 72
Accreditation: State Ed. Dept.
Admission: High-school graduation and evidence of ability
Electronics technology**

Duluth Area Vocational-Technical School, Duluth
Public. H. D. Hill, dir.
Total enrolment: 170
Technician enrolment: 40
Accreditation: State Ed. Dept.
Admission: High-school graduation and testing
Electronics technology**, industrial electronic technology*

Hibbing Area Vocational-Technical School, Hibbing
Public. W. E. Magajna, dir.
Total enrolment: 300

Accreditation: State Ed. Dept.
Admission: High-school graduation or non-grad over 18 yrs.
Electronic data processing technology**

Mankato Area Vocational-Technical School, Mankato
Public. F. Kalin, dir.
Total enrolment: 2,311
Technician enrolment: 227
Accreditation: State Ed. Dept.
Admission: High-school graduation, passing scores on prerequisite aptitude tests
Electronic data processing technology**, drafting technology, electrical technology*, electronics technology**, industrial electronic technology, machine tool technology*, steam engineering*

Minneapolis Area Vocational-Technical School, Minneapolis
Public. R. Nord, dir.
Accreditation: State Ed. Dept.
Total enrolment: 11,800
Technician enrolment: 1,060
Aeronautical technology**, electronic data processing technology**, electronics technology**, mechanical technology*

Rochester Junior College, Rochester
Public. C. E. Hill, dean
Total enrolment: 1,154
Technician enrolment: 61
Accreditation: NCA
Admission: Graduation from accredited high school
Electronics technology, engineering technology, laboratory technology

St. Cloud Area Vocational-Technical School, St. Cloud
Public. R. C. Miller, dir.
Total enrolment: 105
Technician enrolment: 35
Accreditation: State Ed. Dept.
Admission: High-school graduation
Electronics technology**, industrial electronic technology*, printing and photoengraving technology

St. Paul Area Vocational-Technical School, St. Paul
Public. H. M. Ostrem, dir.
Total enrolment: 5,800
Technician enrolment: 2,800
Accreditation: State Ed. Dept.
Admission: High-school graduation
Automotive technology**, airconditioning and heating technology*, aeronautical technology*, civil and construction technology*, electronic data processing technology*, drafting technology**, architectural drafting technology**, electrical technology**, electronics technology**, industrial electronic technology**, industrial technology, drafting and tool design**, machine drafting and design**, machine tool technology**, mechanical technology*, metallurgical technology*, printing and photoengraving technology**

Staples Area Vocational-Technical School, Staples
Public. M. Matanich, dir.
Total enrolment: 200
Technician enrolment: 30
Accreditation: State Ed. Dept.
Admission: High-school graduation
Drafting technology, plastics technology, drafting and tool design

Thief River Falls Area Vocational-Technical School, Thief River
Public. A. M. Aune, dir.
Total enrolment: 220
Technician enrolment: 28
Accreditation: State Ed. Dept.
Admission: High-school graduation, algebra and physics required
Electronics technology

Wadena Area Vocational-Technical School, 405 S.W. Colfax, Wadena
Public. C. Swenson, dir.
Total enrolment: 165
Technician enrolment: 65
Accreditation: State Ed. Dept.
Admission: High-school graduation and entrance exams.
Electronics technology, industrial electronic technology, automotive technology

Willmar Community College, Willmar
Public. C. G. Richardson, dir.
Total enrolment: 457
Technician enrolment: 109
Accreditation: State Ed. Dept., U. of Minn.
Admission: High-school graduation
Industrial electronic technology**, mechanical design technology**

Winona Area Vocational-Technical School, 166 W. Broadway, Winona
Public. T. W. Raine, dir.
Total enrolment: 105
Technician enrolment: 70
Accreditation: State Ed. Dept.
Admission: High-school graduation or 18 yrs. or over
Electrical technology, electronics technology, machine tool technology

MISSISSIPPI

Biloxi High School, Biloxi
Public. R. D. Brown, supt.
Total enrolment: 1,381
Technician enrolment: 158
Accreditation: SA
Electronics technology, electronic data processing technology, aviation electronic technology

Capiah-Lincoln Junior College, Wesson
Public. F. M. Fortenberry, pres.
Total enrolment: 504
Technician enrolment: 27
Building construction technology, mechanical technology

East Central Junior College, Decatur
Public. D. Montgomery, pres.
Total enrolment: 500
Technician enrolment: 50
Accreditation: SA
Admission: High-school graduation
Automotive technology, architectural drafting technology, highway drafting technology

Hinds Junior College, Raymond
Public. G. M. McLendon, pres.
Total enrolment: 1,612
Technician enrolment: 54
Aircraft maintenance technology, drafting and design technology, electronic data processing technology, electronics technology

Itawamba Junior College, Fulton
Public. J. S. Crubaugh, pres.
Total enrolment: 650
Technician enrolment: 100
Accreditation: SA
Admission: High-school graduation
Electronics technology, building construction technology*

Jackson Municipal Separate School District, P. O. Box 918, Jackson
Public. R. H. Bacon, dir.,
Total enrolment: 1,500
Accreditation: SA
Airconditioning and heating technology*, drafting technology*, architectural drafting technology*, electrical technology*, electronics technology*,

Meridian High School, Meridian
Public. L. O. Todd, supt.
Total enrolment: 852
Technician enrolment: 149
Drafting and design technology, electronic technology, industrial technology

Mississippi Delta Junior College, Moorhead
Public. W. B. Horton, pres.
Total enrolment: 513
Technician enrolment: 61
Accreditation: SA
Building construction technology, drafting and design technology, electronics technology

Northwest Mississippi Junior College, Senatobia
Public. R. D. McLendon, pres.
Total enrolment: 813
Technician enrolment: 82
Accreditation: SA
Admission: High-school graduation or satisfactory GED and special test scores
Civil technology, electronics technology

Pascagoula Public Schools, P. O. Box 280, Pascagoula
Public. A. L. Meaders, Voc. Dir.
Total enrolment: 1,100
Technician enrolment: 240-500
Accreditation: State Ed. Dept.
Admission: Aptitude testing, geometry prerequisite
Electronic data processing technology, drafting technology, electrical technology, electronics technology, drafting and tool design, machine drafting and design, machine tool technology, mechanical technology, building trade technology, metal trades technology, welding technology

Pearl River Junior College, Poplarville
Public. G. H. Johnson, pres.
Total enrolment: 684
Technician enrolment: 37
Drafting and design, electronics technology, mechanical technology

Perkinston Junior College, Perkinston
Public. J. J. Hayden, Jr., dir.
Total enrolment: 1,119
Technician enrolment: 152
Accreditation: SA
Admission: High-school graduation or GED test or over 21 yrs. old
Civil technology, drafting and design technology, electronic data processing, electronics technology

MISSOURI

Central Missouri State College, Warrensburg
Public. W. C. Lovinger, pres.
Total enrolment: 5,000
Technician enrolment: 54
Accreditation: NCA
Admission: High-school graduation
Drafting technology, automotive technology, electrical technology, industrial technology

Central Technical Institute, 1644 Wyandotte St., Kansas City
Private. C. L. Foster, pres.
Total enrolment: 575
Technician enrolment: 485
Accreditation: NHSC
Admission: High-school graduation plus at least 1 yr. algebra
Aviation electronic technology**, electronic data processing technology**, electronic engineering technology*†, industrial electronics technology**, nucleonics, commercial broadcast technology*†, practical electronic technology*

The David Ranken, Jr., School of Mechanical Trades, 4431 Finney Avenue, St. Louis
Private. G. B. Rodenheiser, dir.
Total enrolment: 550
Technician enrolment: 308
Admission: High-school graduation, min. age 17 yrs. old, qualifying tests
Automotive technology**, airconditioning and heating technology**, drafting technology**, architectural drafting technology**, electrical technology**, electromechanical technology**, electronics technology**, industrial electronic technology**, drafting and tool design**, machine drafting and design**, machine tool technology**, mechanical design technology**, mechanical technology**, instrumentation*, printing and photoengraving technology**, communication electronics**, refrigeration technology**

Finlay Engineering College, 7 East 79th Terrace, Kansas City 14
Aeronautical technology, electrical technology, mechanical technology, civil technology, refrigeration and airconditioning technology

Franklin Technical School, 1301 Pearl Ave., Joplin
Public. R. W. Baker, dir.
Total enrolment: 875
Technician enrolment: 200
Accreditation: NCA
Admission: High-school graduation plus acceptable test scores
Drafting technology*, electrical technology**, electronics technology**, drafting and tool design*, machine drafting and design*, mechanical technology**

Hickman High School, Columbia
Public. R. C. Shaw, supt.
Total enrolment: 1,400
Technician enrolment: 53
Accreditation: State Ed. Dept., NCA
Electronics technology**

Hillyard Vocational and Technical School, 801 S. 9th Street, St. Joseph
Public. W. P. Green, dir.
Total enrolment: 423
Technician enrolment: 91
Accreditation: NCA
Admission: High-school seniors and junior-college students
Drafting technology**, architectural drafting technology**, electrical technology**, electronics technology**, industrial electronic technology

Kansas City Public Schools, Vocational Education, 1211 McGee St., Kansas City
Public. H. W. Dahlor, dir.
Technician enrolment: 246
Data processing technology**, refrigeration and airconditioning technology*

Kirksville Technical School, Kirksville
Public. O. W. Phillips, supt.
Total enrolment: 350
Technician enrolment: 65
Accreditation: State Ed. Dept.
Admission: High-school graduation
Automotive technology*, civil and construction technology*, drafting technology*, electrical technology*, electronics technology**, drafting and tool design*, machine drafting and design*

Kirksville Senior High School, Kirksville
Public
Total enrolment: 558
Technician enrolment: 110
Accreditation: NCA
Airconditioning and heating technology, civil and construction technology*, electronics technology, industrial electronic technology*,

Linn Area Technical School, Linn
Public. T. Willett, supt.
Total enrolment: 130
Accreditation: State Ed. Dept.
Admission: High-school graduation
Automotive technology, electronics technology, machine drafting and design

Mehlville Senior High School, 3200 Lemay Ferry Road, St. Louis 25
Public. E. Merryman, asst. supt.
Total enrolment: 1,500
Technician enrolment: 62
Accreditation: NCA
Automotive technology, electronics technology**, machine tool technology

Mexico Senior High School, Mexico
L. Buford Thomas, supt.
Technician enrolment: 34
Electronics technology*, mechanical technology*

O'Fallon Technical School, 5101 Northrup, St. Louis 10
Public. C. Tucker, supv.
Total enrolment: 4,000
Technician enrolment: 572
Accreditation: NCA
Electronic data processing technology*, drafting technology*, electrical tech-

nology*, electromechanical technology*, electronics technology**, mechanical technology*, metallurgical technology*

Poplar Bluff Senior High School, Poplar Bluff
Public. D. Simmons, supv.
Total enrolment: 1,300
Technician enrolment: 20
Accreditation: State Ed. Dept.
Admission: High-school graduation
Electronics technology**

St. Louis County Technical School, 5600 Country Day Lane, Berkeley
Public. L. Clark, dir.
Total enrolment: 375
Technician enrolment: 160
Electronic data processing technology*, electronics technology*, drafting and tool design*, machine drafting and design*

Sikeston Senior High School, Sikeston
Public. L. M. Twitty, supt.
Technician enrolment: 115
Electronics technology*, design and drafting**

Springfield Vocational-Technical School, 815 North Sherman, Springfield
Public. D. W. Berryman, dir.
Technician enrolment: 29
Electronics technology, design and drafting.

MONTANA

Flathead County High School, Kalispell
Public.
Civil and construction technology*, electronics technology*

Great Falls Senior High School, Great Falls
Public. R. W. Swarthout, prin.
Total enrolment: 2,840
Technician enrolment: 74
Accreditation: NWA
Electronics technology

Helena Senior High School, Dept. of Aeronautics and Related Trades, 2300 East Poplar, Helena
Public. G. Russell
Total enrolment: 172
Technician enrolment: 20
Accreditation: NWA, Fed. Av. Agency
Admission: Electronics course, 2 yrs. of math
Electronics technology

Missoula County High School, Missoula
Electronics technology*

Northern Montana College, Havre
Public. J. R. Crowley, pres.
Total enrolment: 815
Technician enrolment: 241
Accreditation: NWA
Admission: Residents, graduation from accredited high school; non-residents, graduation in upper half of high-school class or suitable score on ACT
Automotive technology, drafting technology, electrical technology, electronics technology, diesel technology, machine shop technology, welding technology

NEBRASKA

Nebraska Vocational Technical School, Milford
Public. L. A. Welsh, dir.
Total enrolment: 645
Technician enrolment: 465
Accreditation: State Ed. Dept.
Admission: High-school graduation and tests
Automotive technology, airconditioning and heating technology, civil technology, civil and construction technology, electronics data processing technology, drafting technology, architectural drafting technology, electrical technology, electronics technology, drafting and tool design, metallurgical technology

Omaha Area Vocational Technical School, Voc. and Adult Ed., 3912 Davenport St., Omaha 31
Public. C. B. Palmquist, prin.
Total enrolment: 2,114
Technician enrolment: 49
Accreditation: NCA, State Ed. Dept.
Admission: Satisfactory grades in math and science, pre-technical drafting and electronics courses
Drafting technology, electronics technology, instrumentation

NEVADA

Carson City High School, Carson City
Public
Civil and construction technology*

Clark County School District, Adult and Vocational Ed., P. O. Box 551, Las Vegas
Public. R. L. Sturm, dir.
Total enrolment: 5,000
Technician enrolment: 700
Accreditation: NWA, State Ed. Dept.
Admission: High-school graduation, extension classes by examination plus interview
Airconditioning and heating technology**, civil technology*, civil and construction technology*, electronic data processing technology**, drafting technology*, architectural drafting technology*, electronic technology**, industrial electronic technology*

Mineral County School District, Hawthorne
Public. F. Smalley, supt.
Total enrolment: 1,800
Accreditation: NWA
Admission: Resident of Mineral County and high-school graduation
Automotive technology**, electronics technology, industrial electronic technology

Reno High School, Booth Street, Reno
Public
Civil and construction technology*, electronics technology*

South Nevada Technical Institute, Las Vegas
Public
Electronics**

University of Nevada, Reno. Extension Centers at Carson City, Ely, Fallon, and Lovelock
Public. H. J. Wolf, dir., (Reno)
Total enrolment: 3,080
Technician enrolment: 664
Admission: High-school graduation, passing entrance exam in area of training
Civil technology*, civil and construction technology*, electronic data processing technology*, drafting technology*, architectural drafting technology*, electrical technology*, electronics technology*, instrumentation

White Pine County High School, Ely
Public
Electronics technology*

NEW HAMPSHIRE

Berlin School District, Berlin
Public
Electronics technology*

Claremont School District, Claremont
Public
Mechanical technology*

Concord School District, Concord
Public
Electronics technology*

Dover School District, Dover
Public
Mechanical technology*

Nashua School District, Nashua
Public
Electronics technology*

New Hampshire Technical Institute,
57 Webster St., Manchester
Electrical technology, electronics technology, mechanical technology

NEW JERSEY

Bergen County Vocational and Technical High School,
200 Hackensack, Hackensack
Public. H. Stephan, dir.
Total enrolment: 1,697
Technician enrolment: 76
Accreditation: State Ed. Dept.
Admission: High-school graduation or equivalent, qualifying aptitude test
Chemical technology, drafting and design technology, electrical technology, electronics technology

Camden County Vocational-Technical School, 6008 Browning, Merchantville
Public. J. Kreisell, dir.
Total enrolment: 700
Technician enrolment: 100
Electronics technology**, industrial electronic technology**, drafting and tool design**, machine drafting and design**, metallurgical technology**, printing and photoengraving technology*, nuclear chemistry**

Cape May County Vocational Technical Institute, Franklin St., Cape May
Public
Total enrolment: 109
Technician enrolment: 57
Accreditation: State Ed. Dept.
Admission: High-school graduation or equivalent
Drafting technology**, architectural drafting technology*, electronics technology**, industrial electronic technology*

Electronic Training Center,
7300 Crescent Blvd., Pennsauken
Private. M. Freedland, adm.
Total enrolment: 145
Technician enrolment: 60
Accreditation: State Ed. Dept.
Admission: Personal interview
Electronics technology

Essex County Vocational and Technical High Schools,
209 Franklin St., Bloomfield
Public. J. S. Umowski, dir.
Total enrolment: 2,000
Accreditation: State Ed. Dept.
Aeronautical technology**, drafting technology**, architectural drafting technology**, electrical technology**, electronics technology**, industrial electronic technology**, industrial technology**, drafting and tool design**, machine drafting and design**, machine tool technology**, mechanical design technology**, mechanical technology**, metallurgical technology**

Essex County Vocational and Technical High School,
Myrtle Ave. and University Pl., Irvington
Public.
Accreditation: State Ed. Dept.
Electrical technology**, electronics technology**, mechanical technology**

Essex County Vocational and Technical High Schools,
Sussex Ave. and First St., Newark, (adm. offices)
Public. G. Morgenroth, dir.
Total enrolment: 2,790
Technician enrolment: 350
Accreditation: State Ed. Dept.
Admission: High-school graduation, personal interview
Chemical and metallurgical technology**, electronics technology**, drafting and design**, electrical technology**, aeronautical technology**, industrial technology**, electronic data processing technology*, refrigeration and airconditioning technology**, architectural drafting technology*, mechanical technology**

Middlesex County Vocational and Technical High Schools and Adult Technical Schools,
New Brunswick and Perth Amboy
Public. B. D. Coe, dir.
Total enrolment: 3,753
Technician enrolment: 730
Accreditation: State Ed. Dept.
Admission: Test battery, interview, and high-school graduation
Airconditioning and heating technology*, electronics technology**, machine drafting and design, instrumentation*, industrial chemical technology**

Ocean County Vocational and Technical Schools, Water St., Toms River
Public. K. Miller, dir.
Accreditation: State Ed. Dept.
Admission: High-school graduation or equivalent
Drafting and design technology, electronics technology

Radio-Electronics-Television School,
255 Passaic Ave., Kearny
Private. L. Howard, pres.
Total enrolment: 516
Technician enrolment: 125
Accreditation: State Ed. Dept.
Admission: Personal interview
Electronics technology

RCA Technical Institute,
Cherry Hill, Delaware Twp., Camden
Private. L. W. Snow
Total enrolment: 160
Technician enrolment: 60
Accreditation: State Ed. Dept.
Admission: Personal interview
Data processing technology

Salem County Vocational-Technical Institute, Penns Grove
Public. H. C. Donaghay, dir.
Total enrolment: 154
Technician enrolment: 95
Accreditation: State Ed. Dept.
Admission: High-school graduation or equivalent
Automotive technology*, drafting technology**, electrical technology*, electronics technology**, machine drafting and design**, mechanical technology**, instrumentation**, chemical technology**, scientific glassblowing technology**

Somerset County Vocational-Technical Schools, Somerville
Public. W. J. Schott, dir.
Total enrolment: 1,300
Technician enrolment: 306
Accreditation: State Ed. Dept.
Admission: High-school graduation and test
Electronic data processing technology**, drafting technology**, building technology*

Sussex County Vocational and Technical Schools,
County Serv. Bldg., Newton
Public. J. Cummings, dir.
Total enrolment: 256
Technician enrolment: 45
Accreditation: State Ed. Dept.
Admission: High-school graduation or equivalent, personal interview
Automotive technology, drafting and design technology, electronics technology, metals technology

Trenton Junior College, Trenton 8
Public. John Perry Pritchett, pres.
Total enrolment: 1,209
Technician enrolment: 150
Accreditation: MSA
Admission: Good high-school record and SAT score
Civil technology, electronic data processing technology, architectural drafting technology, electrical technology, chemical technology, mechanical technology, engineering technology

TRENTON TECHNICAL INSTITUTE, 636 E. State St., Trenton
Private. J. Freund, dir.
Total enrolment: 243
Technician enrolment: 95
Accreditation: State Ed. Dept.
Admission: Personal interview
Electronics technology

UNION COUNTY VOCATIONAL-TECHNICAL INSTITUTE, Union City
Public. G. H. Baxel, dir.
Total enrolment: 831
Technician enrolment: 569
Accreditation: State Ed. Dept.
Admission: High-school graduation and admission tests
Electronic data processing technology**, drafting technology**, electromechanical technology**

UNION TECHNICAL INSTITUTE, 1021 Stuyvesant Ave., Union
Private. P. Barotta, dir.
Total enrolment: 61
Technician enrolment: 37
Accreditation: State Ed. Dept.
Admission: Personal interview
Electronics technology

WARREN COUNTY VOCATIONAL SCHOOL AND TECHNICAL INSTITUTE, 151 W. Washington Ave., Washington
Public. C. Green, dir.
Total enrolment: 373
Technician enrolment: 27
Accreditation: State Ed. Dept.
Admission: High-school graduation or equivalent, personal interview

NEW MEXICO

ALBUQUERQUE HIGH SCHOOL, 110 Broadway, NE. Albuquerque
Public. W. F. Wright, prin.
Total enrolment: 1,848
Technician enrolment: 140
Accreditation: NCA
Electronics technology, drafting and tool design, machine tool technology

CARLSBAD HIGH SCHOOL, Carlsbad
Public. William W. Loos, prin.
Total enrolment: 1,200
Accreditation: NCA
Electronics technology*

EASTERN NEW MEXICO UNIVERSITY, Technician Education, Portales
Public. A. Bettina, dir.
Total enrolment: 2,300
Technician enrolment: 40
Accreditation: NCA
Admission: Graduation from accredited high school
Civil technology, drafting technology

RATON INSTRUCTION CENTER, Raton
Public
Electronics technology*

ROSWELL HIGH SCHOOL, Roswell
Electronics technology*

SANTA FE HIGH SCHOOL, 200 Lincoln Ave., Santa Fe
Public. T. B. Walsh, prin.
Total enrolment: 1,685
Technician enrolment: 180
Accreditation: NCA
Automotive technology, drafting technology, machine tool technology

NEW YORK

ACADEMY OF AERONAUTICS, La Guardia Airport, Flushing 71
Private. C. L. Jones, pres.
Total enrolment: 1,200
Technician enrolment: 1,200
Aeronautical technology†, aviation electronic technology†, electronics technology†, aerospace design technology†

AGRICULTURAL AND TECHNICAL INSTITUTE AT ALFRED, State University of New York, Alfred
Public. R. F. Rawe, dean
Total enrolment: 1,450
Technician enrolment: 450
Accreditation: MSA
Admission: High-school graduation, 16 yrs. old, pass state university entrance exam, 3 yrs. math, 2 yrs. science including physics
Airconditioning and heating technology*†, civil technology†, electronic data processing technology*, drafting technology*, electrical technology†, electronics technology†, mechanical technology†, diesel technology†, engineering science†

AGRICULTURAL AND TECHNICAL INSTITUTE AT CANTON, Canton
Public. G. E. Wright, pres.
Total enrolment: 618
Accreditation: MSA
Admission: High-school graduation
Automotive technology, electrical and electronic technology, mechanical technology

AGRICULTURAL AND TECHNICAL INSTITUTE AT DELHI, Delhi
Public. W. R. Kunsela, pres.
Total enrolment: 608
Admission: High-school graduation, recommendation from high-school principal or guidance counselor, pass admissions examinations

AGRICULTURAL AND TECHNICAL INSTITUTE AT FARMINGDALE, Farmingdale
Public. C. W. Laffin, Jr.
Total enrolment: 5,582
Accreditation: MSA
Admission: High-school graduation, units of math, evidence of ability to handle college-level studies
Airconditioning technology, architectural and civil technology, chemical technology, electronic and electrical technology, instrumentation technology, mechanical power technology, mechanical technology, photographic equipment technology

AGRICULTURAL AND TECHNICAL INSTITUTE AT MORRISVILLE, Morrisville
Public. R. N. Whipple, pres.
Total enrolment: 867
Accreditation: MSA
Admission: High-school graduation
Electrical and electronic technology

AUBURN COMMUNITY COLLEGE, Franklin Street, Auburn
Public. A. T. Skinner, pres.
Total enrolment: 1,360
Accreditation: State Ed. Dept.
Admission: High-school graduation
Industrial technology

BROOME TECHNICAL COMMUNITY COLLEGE, Binghamton
Public. C. C. Tyrrell, pres.
Total enrolment: 2,450
Technician enrolment: 285
Accreditation: MSA
Admission: High-school graduation, math through trigonometry and one physical science
Civil technology**†, electrical technology*†, industrial technology**, mechanical technology*†, chemical technology*†

CORNING COMMUNITY COLLEGE, Corning
Public. W. L. Perry, pres.
Total enrolment: 555
Accreditation: State Ed. Dept.
Mechanical technology

DUTCHESS COMMUNITY COLLEGE, Pendell Road, Poughkeepsie
Public. J. F. Hall, pres.
Total enrolment: 1,100
Accreditation: State Ed. Dept.
Admission: High-school graduation or equivalent
Architectural drafting technology†, electronics technology†, mechanical design technology†

EDISON TECHNICAL-INDUSTRIAL HIGH SCHOOL, 725 Clifford Ave., Rochester
Electrical technology, mechanical design and construction, instrumentation

ERIE COUNTY TECHNICAL INSTITUTE, Main and Youngs Road, Buffalo 21
Public. L. E. Spring, pres.
Total enrolment: 1,874
Technician enrolment: 1,156
Accreditation: U. of the State of N. Y.
Admission: High-school graduation with principal's recommendation, satisfactory scores on State University entrance examination
Airconditioning and heating technology*, civil and construction technology†, architectural drafting*, electrical technology†, industrial technology, drafting and tool design*, machine drafting and design*, mechanical technology†, metallurgical technology, instrumentation*, chemical technology†

HORNELL HIGH SCHOOL, Park Street, Hornell
Public
Electronics*

HUDSON VALLEY COMMUNITY COLLEGE, Troy
Public. O. V. Guenther, pres.
Total enrolment: 2,495
Accreditation: State Ed. Dept.
Admission: High-school graduation, algebra, exam
Airconditioning technology, automotive technology, chemical technology, electrical technology, electronics technology, mechanical technology

JAMESTOWN HIGH SCHOOL, Jamestown
Public. F. Filmer, dir.
Electrical technology*

LEVITTOWN, NEW YORK, PUBLIC SCHOOLS (UNION FREE SCHOOL DISTRICT NO. 5), North Village Green, Levittown
Public. B. F. Rappaport, asst. to supt.
Total enrolment: 3,000
Technician enrolment: 180
Accreditation: State Ed. Dept.
Admission: Science aptitude test, IQ 110, previous record, recommendation of prin., interview
Electronics technology**, printing and photoengraving technology**, mechanical design and metallurgy**

MOHAWK VALLEY TECHNICAL INSTITUTE, Utica
Public. A. V. Payne, pres.
Total enrolment: 1,200
Technician enrolment: 581
Accreditation: MSA
Civil technology**, electrical technology**†, mechanical technology**†

Distinction between Quality and Level

A large number of programs have been inaugurated in recent years under the name of technical curricula. They have had a variety of goals and a corresponding diversity of educational levels. This diversity has been a source of disagreement among educators and of confusion to the public, legislators, employers, parents, and students. The Committee believes that a distinction should be made between the quality of a program and its educational or difficulty level.

The level of a program is determined by its objectives, and the quality by how well it achieves these objectives. If, for example, the objective of a program is to train retarded persons to perform simple household tasks, it may excel at accomplishing this objective. On the other hand, a graduate program in a highly abstract field may well be of poor quality.

Some technical curricula intend to cover their subject matter at a level close to that of the engineering college, or at least that of the engineering college of a few years ago. Others set their objectives at essentially the same level of difficulty as the secondary school. Between these extremes we find a well-distributed range of objectives and levels. The sole point of agreement, and even that is not unanimous, is that technical education is post-high school. Almost all technical curricula are admittedly *after* high school, but misunderstanding arises because the term post-high school is chronological rather than indicative of level of difficulty.

The level at which a technical program is cast depends largely on the type of position for which the graduates are being educated. In the early years of the technical education movement, it may have been assumed that the range of positions between the craftsman and the engineer was narrow enough for a single level of curricula to prepare students to occupy positions throughout the entire range. This can no longer be taken for granted.

Recent occupational analyses have indicated that the range between the craftsman and the engineer includes positions which vary considerably in the level of technical education required. The diversity in educational levels mentioned above is undoubtedly a reflection of this occupational diversity.

Confusion has resulted in many instances, however, because institutions have continued to generalize in their statements of objectives and have at least implied that they are trying to cover the entire range. As a consequence, differences in level have often been interpreted as differences in quality.

The distinction between quality and level is prerequisite to the formulation of educational standards. The Committee believes that quality standards can be stated only for a given level of education.

Some technical educators have suggested that two levels of technicians be recognized and that one level be called the engineering technician and the other level the industrial technician or the highly-skilled technician. It may well be that there is need for even further division of the range.

From Characteristics of Excellence in Engineering Technology Education, *final Committee report of The Evaluation of Technical Institute Education Study by the American Society for Engineering Education, 1962, James L. McGraw, Project Director.*

Nassau County Trade and Technical Center, Westbury
Public. Richard Klett, prin.
Technician enrolment: 100
Electronics technology**, mechanical technology, computer technology, drafting technology**, automotive technology**, airconditioning technology**

New York City Community College of Applied Arts and Sciences, 300 Pearl Street, Brooklyn
Public. M. H. Block, pres.
Total enrolment: 8,524
Accreditation: MSA
Admission: High-school graduation or equivalent, general ability and aptitude tests, physical capacity appraisal to determine suitability for particular course
Architectural and civil technology, chemical technology, electrical and electronics technology

Orange County Community College, Middletown
Public. W. G. Dwyer, pres.
Total enrolment: 2,905
Technician enrolment: 107
Accreditation: MSA
Admission: High-school graduation
Electrical technology**, electronics technology**, industrial technology, mechanical technology

Queens Vocational High School, New York City
Public
Instrumentation

Rome Free Academy, Rome
Public
Electronics**

Sewanhaka High School, 500 Tulip Ave., Floral Park
Public. R. C. Wipper, dist. dir.
Total enrolment: 12,960
Technician enrolment: 972
Accreditation: MSA
Admission: Excellence in math and science, passing grades in mandated subjects
Automotive technology**, architectural drafting technology, electrical technology**, electronics technology**, industrial electronic technology**, drafting and tool design, machine drafting and design, mechanical design technology, instrumentation, printing and photo engraving technology

Saunders Trade and Technical High School, Yonkers
Public. G. Kleitz, prin.
Architectural drafting and building construction, electrical technology, industrial chemistry, mechanical design and construction

Suffolk County Community College, 533 College Road, Selden
Public. A. M. Ammerman, pres.
Total enrolment: 1,200
Technician enrolment: 100
Accreditation: State U. of N. Y.
Admission: High-school graduation
Electronics technology, mechanical technology

Suffolk County Board of Education, District No. 2, Vocational Center, Bayport
Public
Electronics

Syracuse Central Technical High School, 717 South Warren St., Syracuse
Public. W. E. Haws, actg. dir.
Total enrolment: 2,600
Technician enrolment: 1,300
Accreditation: State Ed. Dept.
Automotive technology*, airconditioning and heating technology*, electronic data processing technology*, drafting technology*, electrical technology*, electromechanical technology*, electronics technology*, industrial electronic technology, drafting and tool design, machine tool technology*, mechanical technology*, metallurgical technology*, instrumentation*, printing and photoengraving technology*

Thomas A. Edison Vocational and Technical High School, 60 S. 3rd Avenue, Mt. Vernon
Public. D. A. Panitz, prin.
Electronics technology, industrial chemistry, mechanical design and construction

Trott Vocational High School, 11th St. and Ashland Ave., Niagara Falls
Public. C. M. Armstrong, prin.
Industrial chemistry, structural drafting and design

Voorhees Technical Institute, 304-319 E. 67th Street, New York 21
Private. E. H. Miner, pres.
Total enrolment: 289
Technician enrolment: 281
Accreditation: U. of the State of New York
Admission: High-school graduation, two years high-school math, one year science
Automotive technology*, airconditioning and heating technology**, electronics technology**, industrial electronic technology**, drafting and tool design*, materials processing**

Westchester Community College, 75 Grasslands Road, Valhalla
Public. P. C. Martin, pres.
Total enrolment: 3,100
Technician enrolment: 1,600
Accreditation: State Ed. Dept.
Admission: High-school graduation or equivalent, math and science background
Civil and construction technology**, electrical technology, electronics technology, mechanical technology**, industrial chemistry**

Westchester County Board of Education, District No. 3, Valhalla
Public
Electronics technology

NORTH CAROLINA

Asheville-Buncombe Industrial Education Center, 340 Victoria Road, Asheville
Public. T. W. Simpson, dir.
Total enrolment: 4,728
Technician enrolment: 125
Accreditation: State Ed. Dept.
Admission: 16 yrs. old, high-school graduation, acceptable aptitude, personal interview
Automotive technology**, airconditioning and heating technology**, electronic data processing technology, drafting technology, electronics technology**, machine drafting and design**, mechanical technology, instrumentation**, chemical technology

Burlington-Alamance Industrial Education Center, 411 Camp Road, Burlington
Public. W. E. Taylor, dir.
Airconditioning and heating technology**, electronic data processing technology**, drafting technology**, electrical technology**, electronics technology**, drafting and tool design**, machine tool technology**, mechanical design technology**, industrial chemical technology**

Catawba County Industrial Education Center, Newton
Public. B. Bishop, asst. dir.
Total enrolment: 2,500
Technician enrolment: 100
Accreditation: State Dept. of Community Colleges
Admission: High-school graduation, with preference given to those having advanced mathematics and science
Airconditioning and heating technology**, drafting technology**, architectural drafting technology**, electronic technology**, mechanical design technology**

CHARLOTTE INDUSTRIAL EDUCATION CENTER, 1141 Elizabeth, Charlotte 4
Public. D. Davis, dir.
Electronics technology**, mechanical technology, production technology*

DURHAM INDUSTRIAL EDUCATION CENTER, P. O. Box 1341, 1637 Lawson St., Durham
Public. H. K. Collins, dir.
Total enrolment: 376
Technician enrolment: 106
Admission: High-school graduation or equivalent
Automotive technology**, airconditioning and heating technology**, civil technology, civil and construction technology**, drafting technology**, architectural drafting technology, electronics technology**, drafting and tool design, machine drafting and design**, mechanical technology, chemical technology

FAYETTEVILLE AREA INDUSTRIAL EDUCATION CENTER, P. O. Box 4236, Fayetteville
Public. J. Standridge, dir.
Total enrolment: 800
Technician enrolment: 195
Accreditation: State Ed. Dept.
Admission: High-school graduation, courses in science and math, GATB test
Automotive technology*, airconditioning and heating technology, civil technology**, drafting technology**, architectural drafting technology**, electronic technology**, machine drafting and design**

GASTON TECHNICAL INSTITUTE, Gastonia
Public. W. R. Halstead, dir.
Technician enrolment: 316
Admission: 2 units of high-school algebra, 1 unit of high-school plane geometry
Civil technology†, electrical technology†, electronics technology†, mechanical technology†

GOLDSBORO INDUSTRIAL EDUCATION CENTER, P. O. Box 1259, Goldsboro
Public. H. B. Monroe, dir.
Total enrolment: 135
Technician enrolment: 40
Accreditation: State Dept. of Community Colleges
Admission: High-school graduation or mature individuals qualifying on the Employment Security Commission's GATB
Drafting technology**, architectural drafting technology*, electrical technology*, electronics technology**, industrial electronic technology*, mechanical design technology**, metallurgical technology*

GUILFORD INDUSTRIAL EDUCATION CENTER, P. O. Box 309, Jamestown
Public. B. B. Roberts, dir.
Electronics technology

LEAKSVILLE-ROCKINGHAM COUNTY INDUSTRIAL EDUCATION CENTER, Stadium Drive, Spray
Public. G. W. Armfield, asst. dir.
Total enrolment: 976
Admission: High-school graduation or equivalent, satisfactory GATB score
Drafting technology, electronics technology, machine drafting and design, mechanical technology, textile technology

LENOIR COUNTY INDUSTRIAL EDUCATION CENTER, P. O. Box 1296, Kinston
Public. D. C. Wise, dir.
Total enrolment: 150
Technician enrolment: 30
Accreditation: State Ed. Dept.
Admission: High-school graduation or equivalent
Drafting technology, electronics technology**, chemical technology

WILMINGTON INDUSTRIAL EDUCATION CENTER, 9 South 13th St., Wilmington
Public. M. J. McLeon, actg. dir.
Total enrolment: 1,921
Technician enrolment: 91
Accreditation: State Ed. Dept.
Admission: High-school graduation, subject preparation varies for training field
Airconditioning and heating technology*, civil and construction technology*, architectural drafting technology*, electromechanical technology**, metallurgical technology*, instrumentation*, chemical analysis*, water chemistry*

WILSON INDUSTRIAL EDUCATION CENTER, P. O. Box 921, Wilson
Public. S. Del-Mastro, dir.
Total enrolment: 1,500
Technician enrolment: 240
Admission: High-school graduation or equivalent
Automotive technology**, airconditioning and heating technology**, drafting technology*, electronics technology**, industrial electronic technology, machine drafting and design, machine tool technology*, mechanical technology

WINSTON-SALEM FORSYTH COUNTY INDUSTRIAL EDUCATION CENTER, 2100 Link Rd., Winston-Salem
Public. E. B. Parry, dir.
Total enrolment: 178
Technician enrolment: 155
Accreditation: State Dept. of Community Colleges
Admission: High-school graduation, aptitude determined by GATB score and other aptitude tests, 1 unit in algebra required
Electronics technology**, industrial electronic technology*, industrial technology*, machine drafting and design, mechanical technology**

NORTH DAKOTA

NORTH DAKOTA STATE SCHOOL OF SCIENCE, Wahpeton
Public. G. W. Haverty, pres.
Total enrolment: 1,701
Technician enrolment: 513
Admission: Technical division—high-school graduation or 17 yrs. or over
Civil technology, electronic data processing technology, architectural drafting technology, electrical technology, electronics technology, machine drafting and design, electronic drafting technology, refrigeration and airconditioning technology

OHIO

ASHTABULA TECHNICAL SCHOOL, Ashtabula
Public. C. A. Meister, dir.
Admission: High-school graduation, recommendation by principal
Electronic engineering technology, mechanical engineering technology

BARBERTON SCHOOL OF TECHNOLOGY, 489 W. Hopocan, Barberton
Public. W. E. Bauer, dir.
Technician enrolment: 86
Accreditation: State Ed. Dept.
Admission: High-school graduation, entrance tests
Mechanical technology, chemical technology

CANTON AREA TECHNICAL SCHOOL, 618 High St., Canton 2
Public. G. R. Weiler, supv.
Admission: High-school graduation, recommended by principal, satisfactory scores on engineering and physical science aptitude tests
Mechanical technology, electrical technology

CHANDLER TECHNICAL SCHOOL, 37047 Ridge Road, Willoughby
Public. R. A. Heitzelman, dir.
Total enrolment: 200
Admission: High-school graduation, strong math and science high-school background, satisfactory test scores
Electronic data processing technology**, drafting technology*, electrical technology**, electronics technology**, drafting and tool design*, machine drafting and design*, machine tool technology*, mechanical technology**

COLUMBUS AREA TECHNICIAN SCHOOL, 245 W. Broad St., Columbus 22

Public. C. E. Tatsch, dir.
Admission: High-school graduation, necessary aptitude
Business data processing, electronics technology, mechanical technology

Dayton Public Night School, 118 East 1st St., Dayton
Public. P. C. Snyder, prin.
Total enrolment: 30
Accreditation: State Ed. Dept.
Admission: High-school graduation, aptitude and upper ⅓ in class standing
Printing and photoengraving technology**

Hamilton Technical School, 332 Dayton Street, Hamilton
Public. A. C. Woedl, dir.
Technician enrolment: 52
Total enrolment: 52
Accreditation: State Ed. Dept.
Admission: High-school graduation or equivalent, strong in math and science background
Electrical technology**, mechanical technology**

Lorain School of Technology, Tenth and Brownell Ave., Lorain
Public. M. J. Lerner, dir.
Total enrolment: 152
Technician enrolment: 152
Admission: High-school graduation with good math background
Civil technology, electrical technology, industrial technology, mechanical technology

Mansfield High School, 145 W. Park Blvd., Mansfield
Public. V. H. Oberlander, supv.
Technician enrolment: 36
Admission: High-school diploma, proper background in math
Electrical technology**, electronics technology**, industrial technology**, mechanical technology**

Mansfield Technical School, 218 Marion Ave., Mansfield
Public. G. N. Yoder, dir.
Total enrolment: 56
Technician enrolment: 56
Accreditation: State Ed. Dept.
Admission: High-school graduation, 2 yrs. math (algebra and geometry), prescribed results on GATB, 2 yrs. science, recommendation of principal
Electrical technology**, mechanical technology**

Martins Ferry High School, Martins Ferry
Public. J. Yoder, prin.
Total enrolment: 980
Technician enrolment: 160
Accreditation: NCA
Electronics technology, drafting and tool design, machine tool technology

Max Hayes Trade School, 4600 Detroit Avenue, Cleveland 2
Public. W. C. Scott, prin.
Total enrolment: 1,850
Technician enrolment: 160
Admission: 1 yr. of algebra, 1 yr. of geometry, 1 yr. of physics or chemistry
Electronics technology, industrial technology, mechanical technology

Ohio College of Applied Science, 1104 Walnut St., Cincinnati 10
Private. W. W. Culp, pres.
Total enrolment: 1,650
Technician enrolment: 450
Admission: High-school graduation or equivalent, 1 yr. algebra, 1 yr. plane geometry, 1 yr. either physics, chemistry or advanced mathematics
Mechanical engineering technology†, civil engineering technology, electrical engineering technology†, electronics technology†, building construction technology, chemical technology†

Piketon Vocational School, Piketon
Public. G. O'Dell, dir.
Total enrolment: 112
Electronics technology

Portsmouth High School, Gallia and Waller Sts., Portsmouth
Public. O. M. Gwinn, supv.
Total enrolment: 1,042
Technician enrolment: 19
Accreditation: State Ed. Dept.
Electronics technology

Salem School of Technology, 1200 East Sixth St., Salem
Public. H. W. Cameron, dir.
Total enrolment: 67
Technician enrolment: 67
Accreditation: State Ed. Dept.
Admission: High-school graduation and satisfactory GATB score, 1 yr. of algebra
Electrical technology, mechanical technology

Sinclair College, Dayton
Private. C. C. Bussey, pres.
Total enrolment: 1,648
Technician enrolment: 650
Admission: High-school graduation with 1½ units algebra and 1 unit plane geometry
Electronics technology**†, mechanical technology**†

Springfield and Clark County Post-High School, Springfield
Public. R. O. Brinkman, dir.
Total enrolment: 144
Technician enrolment: 144
Accreditation: State Ed. Dept.
Admission: High-school graduation, aptitude tests, 2 yrs. math in engineering curriculum
Electronic data processing technology, electrical technology, mechanical technology

OKLAHOMA

Cameron State Agricultural College, Lawton
Public. R. B. Burch, pres.
Total enrolment: 1,458
Accreditation: NCA
Admission: High-school graduation
Electrical technology**, electronics technology**, mechanical technology**

Northern Oklahoma Junior College, Tonkawa
Public. V. R. Easterling, pres.
Total enrolment: 632
Accreditation: NCA
Admission: High-school graduation
Electronics technology, electrical technology

Oklahoma City Public Schools, 900 N. Klein, Oklahoma City
Public. J. F. Parker, supt.
Technician enrolment: 479
Accreditation: NCA, State Ed. Dept.
Civil and construction technology, drafting technology, electronics technology

Oklahoma State Tech., Okmulgee
Public. E. Clark, supv.
Electronics technology, mechanical technology

Poteau Community College, Poteau
Public. G. E. Evans, pres.
Total enrolment: 100
Technician enrolment: 15
Accreditation: Okla. Regents for Higher Ed.
Admission: High-school graduation
Electronics technology, chemical technology

Technical Institute, Oklahoma State University, Oklahoma City Branch, 1900 N.W. Tenth St., Oklahoma City
Public. P. P. Chandler, dir.
Technician enrolment: 450
Accreditation: NCA
Admission: Graduation from accredited high school, "C" average or above, ranked scholastically among upper ⅔ of high-school graduating class
Airconditioning and heating technology, civil technology, electronic data processing technology, architectural drafting technology, electronics technology, instrumentation

Technical Institute, Oklahoma State University, Stillwater
Public. H. P. Adams, dir.
Technician enrolment: 356
Accreditation: NCA
Admission: Graduation from accredited high school, "C" average or above, ranked scholastically among upper ⅔ of high-school graduating class
Aeronautical technology, construction technology, electrical technology**†, electronics technology**†, machine drafting and design†, mechanical technology†, fire protection technology†

OREGON

Blue Mountain Community College, 700 S.E. Third, Pendleton
Public. W. W. McCrae, pres.
Total enrolment: 250
Technician enrolment: 150
Accreditation: State Ed. Dept.
Admission: Graduation from accredited high school or equivalent
Automotive technology, civil technology, drafting technology, electromechanical technology, electronics technology, mechanical technology

Central Oregon College, Bend
Public. D. P. Pence, pres.
Total enrolment: 500
Technician enrolment: 175
Accreditation: State Ed. Dept.
Automotive technology, civil technology, drafting technology, electrical technology*, electronics technology, industrial electronic technology, machine tool technology*

Clatsop College, Astoria
Public. R. D. Boss, pres.
Total enrolment: 303
Technician enrolment: 60
Accreditation: State Ed. Dept.
Admission: High-school graduation or equivalent
Automotive technology**, civil technology**, electronics technology**, industrial technology**

Eugene Technical-Vocational School, 200 North Monroe, Eugene
Public. W. W. Cox, dir.
Total enrolment: 500
Technician enrolment: 80
Accreditation: State Ed. Dept.
Admission: High-school graduation or equivalent, or 18 yrs. or older
Civil and construction technology, drafting technology, electronics technology

Oregon Polytechnic Institute, Oregon Polytechnic Building, 4th Ave. at Madison St., Portland 4
Private. A. R. Gale, dir.
Total enrolment: 138
Technician enrolment: 88
Admission: High-school graduation or equivalent
Airconditioning and heating technology*, civil technology, drafting technology*, mechanical technology, land surveying*, architectural engineering technology

Oregon Technical Institute, Oretech Branch P. O., Klamath Falls
Public. W. D. Purvine, pres.
Total enrolment: 1,000
Technician enrolment: 1,000
Accreditation: NWA
Admission: High-school graduation or special student status by review of the admissions standards committee
Automotive technology, airconditioning and refrigeration technology, drafting technology, structural drafting†, electronics technology†, mechanical technology†, highway technology†, surveying technology†, welding technology, machine shop technology

Portland Community College, Portland Public Schools, 515 N.E. 15th Avenue, Portland 12
Public. G. C. Henriksen, dir.
Total enrolment: 6,438
Accreditation: State Ed. Dept.
Admission: High-school graduation or equivalent, 1 yr. algebra and physics
Civil and structural engineering technology, data processing technology, highway engineering technology, technical drafting and design

Portland Electronics College, 1017 S.W. Washington St., 202 New Fliedner Bldg., Portland 5
Private. W. E. Richardson, dir.
Total enrolment: 225
Technician enrolment: 225
Admission: Pre-entrance testing for non-high-school graduate
Electronics technology, industrial electronic technology

Salem Technical Vocational School, 1105 Third Street, NW, Salem
Public. P. F. Wilmeth, supv.
Total enrolment: 450
Technician enrolment: 250
Accreditation: State Ed. Dept.
Civil technology**, civil and construction technology**, electronic data processing technology**, drafting technology**, electronics technology**, machine drafting and design**, mechanical technology**

South Western Oregon College, Box 509, North Bend
Public. W. L. Van Loan, pres.
Total enrolment: 769
Technician enrolment: 365
Accreditation: State Ed. Dept.
Admission: High-school graduation or entrance exams, 1 yr. of high-school algebra and physics
Civil and structural technology, drafting technology, electrical technology, mechanical technology

PENNSYLVANIA

Aliquippa Senior High School, Harding Avenue, Aliquippa
Public
Chemical and metallurgical technology*

Allentown Community College and Technical Institute, Allentown
Public. G. W. Elison, dir.
Total enrolment: 370
Technician enrolment: 85
Accreditation: MSA, Natl. Council Technical Schools
Admission: High-school graduation, principal's recommendation
Drafting technology, electrical technology, drafting and tool design, machine tool technology

Bok Technical High School, 8th and Mifflin Streets, Philadelphia
Public. E. M. Fee, prin.
Data processing*, electrical technology*, electronics technology*, mechanical technology**

Bucks County Technical School, Wistar Road, Fairless Hills
Public. G. M. Schaffer, prin.
Total enrolment: 800
Accreditation: State Ed. Dept.
Admission: Successful completion of math, algebra requirement, above-average intelligence
Electronic data processing, drafting technology, electrical technology, electronics technology, instrumentation, chemical technology

Butler Area Schools, 165 New Castle Road, Butler
Public
Chemical and metallurgical technology*, electrical technology*, electronics technology*, instrumentation*, mechanical technology*

Clairton Evening School, Fifth Street, Clairton
Public. J. C. Schreck, dir.
Total enrolment: 700
Technician enrolment: 40
Electronics technology*, instrumentation*

Connelly Vocational High School, 1501 Bedford Avenue, Pittsburgh

Public. H. Dosey, prin.
Electrical technology*, instrumentation*

Coughlin High School Annex, N. Washington Street, Wilkes-Barre
Public
Electronics*

Dobbins Technical High School, 22nd and Lehigh Avenue, Philadelphia 32
Public. F. White, prin.
Total enrolment: 2,400
Technician enrolment: 1,000
Admission: High-school graduation and test
Electronic data processing technology, instrumentation

Easton Area Joint High School, 30 N. Second St., Easton
Public. J. O. Tule, dir., ind. and tech. ed.
Total enrolment: 2,000
Technician enrolment: 320
Accreditation: MSA
Electrical technology**, electronics technology**, machine drafting and design**, mechanical design technology**

Forbes Trail Area Technical School, Monroeville
Public. F. J. Brown, dir., tech. ed.
Total enrolment: 450
Admission: Average school grades, above average mental ability, and recommendation from high-school
Civil and construction technology, electronic data processing technology, electronics technology, mechanical technology, chemical technology

Hempfield Area Technical Schools, RD No. 6, Greensburg
Public. P. Hatch, voc. dir.
Electronics technology**

Liberty High School, 240 E. Elizabeth, Bethlehem
Public. L. B. Kehler, dir.
Chemical and metallurgical technology**, civil and construction technology**, electrical technology**, electronics technology**, mechanical technology**

McKeesport Vocational High School, O'Neil Boulevard, McKeesport
Public
Chemical and metallurgical technology*

Pennsylvania State University Commonwealth Campus, Allentown Campus, Allentown
Public. W. R. Grubbs, dean
Total enrolment: 579
Accreditation: MSA
Admission: High-school graduation, 2 yrs. math, satisfactory SATB scores
Electronics technology†, electrical technology†, mechanical technology, machine and tool design†, electronic data processing technology**, chemical technology**

Pennsylvania State University Commonwealth Campus, Altoona Campus, Altoona
Public. R. E. Eiche, dean
Total enrolment: 1,038
Accreditation: MSA
Admission: High-school graduation, 2 yrs. math, satisfactory SATB scores
Electronics technology†, mechanical technology

Pennsylvania State University Commonwealth Campus, Behrend Campus, Station Road, Erie
Public. I. H. Kochel, dir.
Total enrolment: 365
Technician enrolment: 139
Accreditation: MSA
Admission: High-school graduation, college boards, 2 yrs. math
Drafting and design†, electronics and electrical technology†

Pennsylvania State University Commonwealth Community Campus, DuBois Campus, College Place, DuBois
Public. D. S. Hiller, dir.
Total enrolment: 190
Technician enrolment: 87
Accreditation: MSA
Admission: Graduation from an accredited secondary school, scholastic aptitude test scores from CEEB, 2 units of algebra and/or plane geometry, 3 units of English
Drafting technology†, electrical and electronics technology†

Pennsylvania State University Commonwealth Community Campus, Hazleton Campus, Hazleton
Public. F. C. Kostos, dean
Total enrolment: 275
Technician enrolment: 110
Accreditation: MSA
Admission: Graduation from an accredited secondary school, scholastic aptitude test scores from CEEB, 2 units of algebra and/or plane geometry, 3 units of English
Drafting technology†, electrical and electronics technology†

Pennsylvania State University Commonwealth Community Campus, McKeesport Campus, McKeesport
Public. W. Kearney, dean
Total enrolment: 778
Accreditation: MSA
Admission: Graduation from an accredited secondary school
Electrical and electronics technology†, engineering technology, mechanical technology

Pennsylvania State University Commonwealth Community Campus, New Kensington Campus, New Kensington
Public. E. E. Heide, dean
Total enrolment: 558
Accreditation: MSA
Electronics and electrical technology, mechanical technology

Pennsylvania State University Commonwealth Community Campus, Ogontz Campus, Philadelphia
Public. C. Herpel, dean
Total enrolment: 1,773
Accreditation: MSA
Admission: High-school graduation
Electronics and electrical technology†, industrial technology, mechanical technology

Pennsylvania State University Commonwealth Community Campus, Pottsville Campus, Pottsville
Public. H. I. Herring, dean
Total enrolment: 232
Accreditation: MSA
Mechanical technology, drafting and design technology†

Pennsylvania State University Commonwealth Community Campus, Scranton Campus, 1625 Wyoming Avenue, Scranton
Public. R. E. Dawson, dir.
Total enrolment: 260
Technician enrolment: 160
Accreditation: MSA
Admission: Upper ⅗ of graduating class, 2 yrs. of math, including algebra, SAT or Penn State Entrance Test required for 1964
Architectural drafting technology*, electrical technology*, electronics technology*, drafting and tool design*, machine drafting and design*, instrumentation*, electrical and electronics technology†, drafting and design technology†

Pennsylvania State University Commonwealth Community Campus, Wilkes-Barre Campus, Wilkes-Barre
Public. G. W. Bierly, dir.
Total enrolment: 320
Technician enrolment: 320
Accreditation: MSA

Admission: Upper ⅗ of graduating class, 2 yrs. of math, including algebra
Electrical technology†, drafting and design technology†, electrical and electronic technology†, surveying technology†

Pennsylvania State University Commonwealth Community Campus, Wyomissing Center, Wyomissing
Public. H. W. Perkins, dean
Total enrolment: 204
Accreditation: MSA
Admission: Upper ⅗ of graduating class, 2 yrs. of math, including algebra
Chemical technology, electrical and electronics technology†, mechanical technology

Pennsylvania State University Commonwealth Community Campus, York Campus, York
Public. E. M. Elias, dean
Total enrolment: 131
Accreditation: MSA
Admission: Upper ⅗ of graduating class, 2 yrs. of math, including algebra
Electrical and electronics technology†, industrial technology, mechanical technology

Penn Technical Institute, 5440 Penn Ave., Pittsburgh
Private. L. A. Dimasi, dir.
Total enrolment: 450
Technician enrolment: 450
Admission: High-school graduation and 1 yr. algebra
Electronics technology

Point Park Junior College, 201 Wood St., Pittsburgh 22
Private. D. C. Finkelhar, pres.
Total enrolment: 1,850
Technician enrolment: 85
Accreditation: State Ed. Dept.
Admission: High-school graduation, satisfactory grades, recommendation from prin. and/or counselor, CEEB recommended
Drafting technology, electronics technology

Reading Senior High School, 13th and Douglas Streets, Reading
Public. R. P. Kyle, prin.
Total enrolment: 2,537
Technician enrolment: 40
Electrical technology**, electronics technology

South Vocational High School, South 10th and Carson Streets, Pittsburgh
Public. J. McLaughlin, prin.
Chemical and metallurgical technology

Spring Garden Institute, Broad and Spring Garden Streets, Philadelphia
Private. L. Ramsey, exec. v.p.
Accreditation: St. Council of Ed.
Admission: High-school graduation with 2 units of math and 2 units of science
Total enrolment: 860
Building construction and design technology, chemical technology, electronics and electrical technology†, mechanical engineering technology†

Technical High School, 723 Adams Avenue, Scranton
Public
Electronics technology**

William Allen High School, 31 S. Penn Street, Allentown
Public
Electronics technology**, mechanical technology

Williamsport Technical Institute, 1005 W. Third St., Williamsport
Public. K. E. Carl, dir.
Total enrolment: 1,800
Technician enrolment: 800
Accreditation: State Ed. Dept.
Admission: High-school graduation or equivalent and pass entrance exam
Automotive technology**, aeronautical technology**, electronic data processing technology**, drafting technology**, architectural drafting technology**, electrical technology**, electronics technology**, industrial electronic technology*, drafting and tool design**, machine drafting and design**, machine tool technology**, instrumentation technology**, diesel technology, building construction technology

PUERTO RICO

Technological Institute of Puerto Rico, 33 Cesar Gonzalez Street, Industrial Zone, Hato Rey, Puerto Rico
Public. J. J. Deig, actg. dir.
Technician enrolment: 125
Admission: High-school graduation and pass entrance examination
Airconditioning and heating technology, civil technology, electronics technology**, mechanical technology

University of Puerto Rico, College of Agriculture and Mechanic Arts, College Station, Mayaguez
Public. L. Steffani, vice-chanc.
Total enrolment: 4,041
Technician enrolment: 109
Accreditation: MSA
Admission: High-school graduation and passing entrance examinations
Drafting and building construction technology, surveying and highway construction technology, mechanical design and metalworking technology, electrical power and electronics technology

RHODE ISLAND

New England Technical Institute of Rhode Island, Inc., 184 Early Street, Providence
Private. E. G. Earle, pres.
Technician enrolment: 135
Admission: High-school graduation or equivalent (day students), electronics or mechanical background (evening students)
Electronics technology, airconditioning, heating and refrigeration technology, electronic data processing, electrical technology, industrial electronic technology

Rhode Island Radio and Electronics School, 45 Mathewson St., Providence
Private. M. R. Reynolds, pres.
Total enrolment: 273
Technician enrolment: 273
Accreditation: State Ed. Dept.
Admission: High-school graduation
Electronics technology

Roger Williams Junior College, 160 Broad St., Providence
Private. H. W. Schaughency, actg. pres.
Total enrolment: 492
Accreditation: State Ed. Dept.
Admission: High-school graduation or equivalent
Industrial technology, construction technology, electronics technology, mechanical technology

Vocational-Technician School of Rhode Island, Corliss Park, Providence
Public. J. Rocchio, prin.
Total enrolment: 700
Technician enrolment: 500
Admission: For extension courses, employment in areas related to instruction
Automotive technology*, electrical technology*, electronics technology*, industrial electronic technology*, machine tool technology*, sanitation technology*

SOUTH CAROLINA

Greenville Technical Education Center, South Pleasantburg Dr., Greenville
Public. T. E. Barton, dir.
Total enrolment: 500
Technician enrolment: 200
Admission: Qualify on the Aptitude Test Battery
Electronic data processing technology, drafting technology, electronics technology, drafting and tool design, machine tool technology, mechanical

technology, instrumentation*, textile technology, chemical technology

Richland Technical Education Center, South Beltline Blvd., Columbia
Public. R. L. Grigsby, dir.
Total enrolment: 150
Technician enrolment: 150
Admission: Students tested and counseled prior to acceptance, must meet certain minimum scores
Civil technology**, civil and construction technology**, electronic data processing technology**, drafting technology**, electronics technology**, mechanical technology**, tool and die design**, chemical technology**

Rock Hill High School, York
Public.
Electronics technology*

South Carolina Area Trade School, Lexington
Public.
Civil and construction technology, electronics technology, mechanical technology

Spartanburg Technical Education Center, Highway I-85, Spartanburg
Public. P. D. Hull, dir.
Total enrolment: 151
Technician enrolment: 64
Admission: 2 yrs. math, satisfactory GATB scores
Automotive technology*, airconditioning and heating technology, drafting technology, electronics technology, industrial electronic technology, drafting and tool design*, machine drafting and design

Sumter Area Technical Education Center, Guinyard and Miller Drives, Sumter
Public. W. Cecil Walters, dir.
Total enrolment: 150
Technician enrolment: 50
Admission: High-school graduation or equivalent and achievement level on battery
Automotive technology*, airconditioning and heating technology*, civil technology**, civil and construction technology**, electronic data processing technology*, drafting technology*, architectural drafting technology*, electrical technology*, electronics technology*, industrial electronic technology*, industrial technology**, drafting and tool design*, mechanical technology*

Tri-County Technical Education Center, Pendleton
Public. W. T. Yarborough, dir.
Total enrolment: 250
Accreditation: State Ed. Dept.
Admission: Tests for placement
Automotive technology, airconditioning and heating technology, civil technology, drafting technology, electronics technology, industrial technology, drafting and tool design, machine drafting and design, mechanical technology, instrumentation

TENNESSEE

Bristol Technical School, 987 Anderson St., Bristol
Public. C. R. Marston, dir.
Total enrolment: 186
Technician enrolment: 68
Accreditation: State Ed. Dept.
Civil and construction technology*, electronic data processing technology*, drafting technology*, architectural drafting technology*, electronics technology*, industrial electronic technology**, drafting and tool design*, machine drafting and design**, communications technology*

Clarksville Area Technical School, 700 Amberland Drive, Clarksville
Public. H. Green, dir.
Electronics technology**, mechanical technology**

Franklin County High School, Winchester
Public.
Electronics technology*

Howard School, Vocational Division, Chattanooga
Public.
Electrical technology*

Jackson High School, Allen Ave., Jackson
Public. F. V. Standley, prin.
Total enrolment: 830
Technician enrolment: 20
Accreditation: SA
Admission: Junior classification, 2 yrs. of math
Civil technology

Knoxville Technical School, Knoxville
Public
Electronics technology**

Knoxville West High School, Knoxville
Public
Mechanical technology

McMinn County High School, Athens
Public. B. E. Childers, prin.
Total enrolment: 1,100
Technician enrolment: 165
Accreditation: SA
Automotive technology**, electronics technology**, machine tool technology**, industrial chemistry**

Memphis Technical High School, 1266 Poplar Avenue, Memphis
Public
Chemical and metallurgical technology, data processing

Morristown High School, Morristown
Public
Electronics technology

Obion County Central High School, Troy
Public
Electronics technology**

Pearl High School, Nashville
Public
Electrical technology**

Wartburg Central High School, Wartburg
Public
Electronics technology**

TEXAS

Amarillo College, Amarillo
Public. A. B. Martin, pres.
Total enrolment: 2,106
Accreditation: SA
Admission: High-school graduation
Chemical technology, engineering technology

Arlington State College, Arlington
Public. J. R. Woolf, pres.
Total enrolment: 9,116
Technician enrolment: 467
Accreditation: SA
Admission: Graduation from an accredited high school, minimum of 15 acceptable units
Aeronautical technology**†, civil technology**†, electrical technology**†, mechanical technology**†

Austin Independent School District, Technician Education, Austin
Public. H. A. Horton, Jr., dir.
Total enrolment: 8,150
Technician enrolment: 980
Accreditation: Texas Ed. Agency
Automotive technology, airconditioning and heating technology, electronic data processing technology, electrical technology, electronics technology, machine tool technology, metallurgical technology, printing and photoengraving technology

FRANK PHILLIPS COLLEGE, Borger
Public. J. W. Dillard, pres.
Total enrolment: 596
Accreditation: SA
Instrumentation

GRAND PRAIRIE INDEPENDENT SCHOOL DISTRICT, Grand Prairie
Public
Aeronautical technology*, data processing*, electronics technology**, mechanical technology*, production technology*

GREENVILLE INDEPENDENT SCHOOL DISTRICT, Greenville
Public
Electronics technology*, mechanical technology*

HOWARD COUNTY JUNIOR COLLEGE, Big Spring
Public. W. A. Hunt, pres.
Total enrolment: 786
Accreditation: SA
Admission: High-school graduation or 18 yrs. old, satisfactory test scores
Electrical and electronics technology, metallurgical technology

IRVING INDEPENDENT SCHOOL DISTRICT, Irving
Public
Electronics

KILGORE COLLEGE, Kilgore
Public. T. E. Bullard, dir.
Total enrolment: 1,500
Technician enrolment: 150
Accreditation: SA
Admission: High-school graduation
Automotive technology, electronic data processing technology, drafting technology, oil and gas technology

LA MARQUE INDEPENDENT SCHOOL DISTRICT, La Marque
Public
Chemical and metallurgical technology*

LE TOURNEAU COLLEGE, Longview
Private. R. H. Le Tourneau, pres.
Total enrolment: 409
Technician enrolment: 205
Admission: High-school graduation, 2 units of math, electives to make up 15 units
Aeronautical technology, civil and construction technology, electrical technology, mechanical technology, printing and photoengraving technology, welding technology

NAVARRO JUNIOR COLLEGE, Corsicana
Public. B. W. Jones, pres.
Total enrolment: 1,000
Technician enrolment: 100
Accreditation: SA
Admission: Graduation from accredited high school
Electronic data processing technology, machine drafting and design

ODESSA COLLEGE, Odessa
Public. J. Rodgers, pres.
Total enrolment: 1,850
Technician enrolment: 160
Accreditation: SA
Admission: High-school graduation
Automotive technology, electronic data processing technology, machine tool technology

PASADENA INDEPENDENT SCHOOL DISTRICT, Pasadena
Public
Instrumentation*

SAN ANTONIO INDEPENDENT SCHOOL DISTRICT, San Antonio
Public
Electronics technology*

SAN JACINTO COLLEGE, 8060 Spencer Highway, Pasadena
Public. M. M. Plexco, dean, tech. div.
Total enrolment: 1,690
Admission: High-school graduation, 2 units in math, 1 unit in natural science
Electronic data processing technology, drafting technology, electronics technology

TEMPLE JUNIOR COLLEGE, Temple
Public. H. M. Dawson, pres.
Total enrolment: 626
Accreditation: SA
Admission: High-school graduation
Data processing

TEXARKANA COLLEGE, Texarkana
Public. W. P. Akin, pres.
Total enrolment: 1,517
Technician enrolment: 25
Accreditation: SA
Admission: High-school graduation; adults admitted on individual approval
Electronic data processing technology, drafting technology

TYLER JUNIOR COLLEGE, Tyler
Public. H. E. Jenkins, pres.
Total enrolment: 3,440
Technician enrolment: 250
Accreditation: SA
Admission: High-school graduation
Electronic data processing technology, drafting technology, architectural drafting technology, electrical technology, industrial electronic technology, instrumentation, surveying, petroleum technology

UNIVERSITY OF HOUSTON, COLLEGE OF TECHNOLOGY, Houston 4
Public. A. R. Sims, dean
Total enrolment: 14,000
Technician enrolment: 800
Accreditation: SA
Admission: High-school graduation with specified units in math, English, etc., satisfactory SAT scores
Airconditioning design technology, civil technology, drafting technology, electrical technology, electronics technology, mechanical technology

WHARTON COUNTY JUNIOR COLLEGE, Wharton
Public. J. M. Hodges, pres.
Total enrolment: 1,225
Accreditation: SA
Admission: High-school graduation
Engineering technology

UTAH

BRIGHAM YOUNG UNIVERSITY, GENERAL COLLEGE, Provo
Private. E. C. Jepsen, dean
Total enrolment: 14,000
Technician enrolment: 600
Accreditation: NWA
Admission: High-school graduation or successful completion of GED tests
Automotive technology*, civil technology**, construction technology**, drafting technology**, electrical technology**, electronics technology**, tool design**, machine drafting and design*, machine tool technology**, mechanical technology, printing and photo engraving technology*, computer programing**, welding technology**

CARBON COLLEGE, Price
Public. I. Longhurst, tech. division chm.
Total enrolment: 450
Technician enrolment: 20
Accreditation: NWA
Admission: High-school graduation or 18 yrs. or older
Machine tool technology

CENTRAL UTAH VOCATIONAL SCHOOL, Box 1009, Provo
Public. A. R. Reed, supv.
Electronics technology, instrumentation*, mechanical technology*

COLLEGE OF SOUTHERN UTAH, Cedar City
Public. M. Roper, tech. division chm.
Total enrolment: 900
Technician enrolment: 15
Building construction technology

SALT LAKE TRADE TECHNICAL INSTITUTE, 431 S. 6th East, Salt Lake City

Public. J. L. Nelson, pres.
Total enrolment: 2,500
Technician enrolment: 500
Accreditation: State Ed. Dept.
Admission: High-school graduation or equivalent entrance examination
Automotive technology**, civil and construction technology**, drafting technology**, architectural technology**, electrical technology**, electronics technology**, machine drafting and design**, mechanical technology**, metallurgical technology, printing and photo engraving technology**

UNIVERSITY OF UTAH, Salt Lake City
Public. E. H. Bradley, ext. div. chm.
Total enrolment: 11,000
Technician enrolment: 150
Accreditation: NWA
Civil engineering technology*, electrical engineering technology*, missile controls technology*, electronics and electrical technology*

UTAH STATE UNIVERSITY, Logan
Public. C. R. Bartel
Total enrolment: 6,000
Technician enrolment: 25
Accreditation: NWA
Admission: High-school graduation or pass GED test
Automotive technology, aeronautical technology, drafting technology, welding technology

UTAH TRADE TECHNICAL INSTITUTE AT PROVO, 1395 North 150 East, Provo
Public. W. W. Sorenson, pres.
Total enrolment: 1,200
Technician enrolment: 350
Accreditation: State Ed. Dept.
Admission: High-school graduation and pass GATB for area
Airconditioning and refrigeration technology**, drafting technology**, architectural drafting technology**, electrical technology**, electromechanical technology**, electronics technology**, industrial electronic technology**, machine drafting and design**, mechanical design technology**, instrumentation**, industrial chemistry**

WEBER STATE COLLEGE,
3750 Harrison Blvd., Ogden
Public. W. P. Miller, pres.
Total enrolment: 3,400
Technician enrolment: 350
Accreditation: NWA
Admission: High-school graduation or equivalent
Automotive technology, electronic data processing technology, drafting technology, architectural drafting technology, electronics technology, industrial technology, drafting and tool design, machine drafting and design, machine tool technology, mechanical technology

VERMONT

BURLINGTON HIGH SCHOOL (EDMUNDS SENIOR HIGH SCHOOL), Burlington
Public. H. L. Smith, prin.
Total enrolment: 1,175
Technician enrolment: 50
Accreditation: State Ed. Dept., NEA
Drafting technology, electrical technology

RUTLAND HIGH SCHOOL, Rutland
Public. M. C. Robinson, prin.
Accreditation: NEA
Electronics technology**, drafting technology*

SPRINGFIELD HIGH SCHOOL, Springfield
Public. L. R. Heath, prin.
Accreditation: NEA
Electronics technology**, drafting technology*

VERMONT TECHNICAL COLLEGE,
Randolph Center
Public. R. A. Young, pres.
Electrical technology, civil technology, mechanical technology

VIRGINIA

DANVILLE TECHNICAL INSTITUTE,
Kemper Rd., Danville
Public. L. A. Hill, dir.
Total enrolment: 350
Technician enrolment: 170
Accreditation: State Ed. Dept.
Admission: High-school graduation and at least 1 yr. algebra
Airconditioning and heating technology, electronic data processing technology, electronics technology, drafting and tool design

NEW RIVER VOCATIONAL-TECHNICAL SCHOOL, Radford
Public. J. D. Hopkins, dir.
Total enrolment: 200
Technician enrolment: 160
Accreditation: State Ed. Dept.
Admission: High-school graduation
Electrical technology, industrial electronic technology, machine drafting and design, machine tool technology, instrumentation**

OLD DOMINION TECHNICAL INSTITUTE OF OLD DOMINION COLLEGE,
5215 Hampton Blvd., Norfolk 8
Public. E. A. Kovner, dir.
Total enrolment: 5,000
Technician enrolment: 250
Accreditation: SA
Admission: High-school graduation, 2 yrs. math required of electronics and airconditioning applicants
Airconditioning and heating technology, drafting technology, architectural drafting technology, electronics technology

RICHMOND PROFESSIONAL INSTITUTE, SCHOOL OF TECHNOLOGY,
901 W. Franklin St., Richmond 16
Public. J. Ankeney, dir.
Total enrolment: 4,500
Technician enrolment: 375
Accreditation: SA
Admission: High-school graduation, 2 yrs. high-school algebra, 1 yr. geometry, 1 yr. lab science.
Civil and highway technology**, electrical and electronics technology**, drafting and design**

ROANOKE TECHNICAL INSTITUTE, Salem
Public. H. S. Oberly, pres.
Total enrolment: 180
Accreditation: SA, State Ed. Dept.
Admission: High-school graduation
Electronics and electrical technology, mechanical technology, engineering technology

VIRGINIA MECHANICS INSTITUTE,
1000 East Marshall, Richmond
Public. W. Eister, supv.
Electronics technology*

WASHINGTON COUNTY VOCATIONAL-TECHNICAL INSTITUTE, Abingdon
Mechanical technology, electronics technology

WISE COUNTY VOCATIONAL-TECHNICAL SCHOOL, Wise
Public. E. E. Fry, dir.
Electronics technology, mechanical technology

WOODROW WILSON VOCATIONAL-TECHNICAL SCHOOL, Fishersville
M. Gray, prin.
Technician enrolment: 31
Accreditation: State Ed. Dept.
Admission: 16 yrs. old or older, passing score on GATB, science and math units required
Design and drafting technology, electronics technology

YORK HIGH SCHOOL, Yorktown
Public. J. H. Stevens, prin.
Technician enrolment: 22
Accreditation: State Ed. Dept.
Electronics technology

WASHINGTON

AUBURN ADULT EDUCATION CENTER,
800 4th Street, NE, Auburn

Public. R. Needham, dir.
Total enrolment: 1,500
Technician enrolment: 1,000
Automotive technology*, aeronautical technology*, aviation electronic technology*, civil and construction technology*, electronic data processing technology*, drafting technology**, electrical technology*, electronics technology**, industrial technology*, drafting and tool design*, machine tool technology*

AUBURN HIGH SCHOOL,
800 4th Street, NE, Auburn
Public
Electronics technology*, instrumentation*, mechanical technology*

BELLEVUE HIGH SCHOOL, Bellevue
Public
Data processing*, electronics technology*

BELLINGHAM TECHNICAL SCHOOL,
3028 Lindberg Ave., Bellingham
Public. R. S. Smith, dir., voc. and adult ed.
Total enrolment: 200
Admission: High-school graduates who have had algebra
Automotive technology, industrial electronic technology, engineering aides

CENTRALIA COLLEGE, Centralia
Public. K. P. Mallery, pres.
Total enrolment: 850
Admission: High-school graduation or 18 yrs. or older
Data processing, industrial electronics technology

CLARK COLLEGE, 1925 Fort Vancouver Way, Vancouver
Public. D. C. Baird, pres.
Total enrolment: 1,600
Admission: High-school graduation
Chemical and metallurgical technology*, electronics technology, mechanical technology*

CLOVER PARK VOCATIONAL SCHOOL,
4500 Steilacoom Blvd., S.W.,
Lakewood Center
Public. F. V. Miner, dir.
Total enrolment: 550
Technician enrolment: 250
Accreditation: State Ed. Dept.
Admission: By test and interview
Automotive technology**, aeronautical technology**, electronic data processing technology**, electronics technology**, industrial electronic technology**

COLUMBIA BASIN COLLEGE,
2600 North Chase Street, Pasco
Public. J. E. Cooney, dir.
Total enrolment: 1,837
Technician enrolment: 640
Accreditation: NWA
Admission: High-school graduation or equivalent
Automotive technology**, airconditioning and heating technology*, civil technology*, civil and construction technology**, electronic data processing technology**, architectural drafting technology, electrical technology*, electronics technology**, industrial electronic technology*, machine tool technology**, metallurgical technology**, instrumentation*, illustration technology, welding technology**

COLUMBIA HIGH SCHOOL, Richland
Public
Nuclear technology*

EDISON TECHNICAL SCHOOL,
1712 Harvard Ave., Seattle 22
Public. J. A. Duncan, supv.
Total enrolment: 11,000
Technician enrolment: 3,000
Accreditation: State Ed. Dept.
Admission: High-school graduation
Automotive technology**, aeronautical technology**, aviation electronic technology**, electronic data processing technology**, drafting technology**, architectural drafting technology**, electrical technology**, electromechanical technology**, electronics technology**, industrial electronic technology**, mechanical design technology**, instrumentation** printing and photoengraving technology*

EVERETT JUNIOR COLLEGE,
801 Wetmore Ave., Everett
Public. R. Berg, pres.
Total enrolment: 2,150
Technician enrolment: 200
Accreditation: State Ed. Dept., NWA
Admission: High-school graduation or 18 yrs. or older, or special permission of dean of students
Automotive technology, electronic data processing technology, electronics technology, industrial electronic technology*, drafting engineering aide, forestry technology

J. M. PERRY INSTITUTE OF TRADES, INDUSTRIES AND AGRICULTURE,
2011 Washington Avenue, Yakima
Private. H. S. Buckman
Total enrolment: 180
Technician enrolment: 180
Admission: High-school graduation
Automotive technology, airconditioning and refrigeration, electrical technology, industrial electronic technology, machine technology, instrumentation

HIGHLINE COLLEGE,
2634 South 142nd Street, Seattle 88
Total enrolment: 700
Admission: High-school graduation
Drafting and design technology

LOWER COLUMBIA COLLEGE, Longview
Public. J. Erickson, dir., tech. and voc. ed.
Total enrolment: 900
Technician enrolment: 200
Accreditation: NWA
Admission: High-school graduation or 18 yrs. of age, or selection tests given
Automotive technology, electrical technology, industrial electronic technology, industrial technology, mechanical design technology, instrumentation

MOSES LAKE HIGH SCHOOL, Moses Lake
Public
Electronics technology*

MT. VERNON HIGH SCHOOL, Mt. Vernon
Public
Electronics technology*, mechanical technology*

OLYMPIA VOCATIONAL-TECHNICAL INSTITUTE, 317 East Fourth Ave., Olympia
Public. W. M. Villines, dir.
Total enrolment: 180
Technician enrolment: 65
Accreditation: State Ed. Dept.
Admission: 18 yrs. of age, high-school graduation, or recommended by high-school principal
Civil technology, electronic data processing technology, architectural drafting technology, electronics technology, highways technology

OLYMPIC COMMUNITY COLLEGE,
16th and Chester, Bremerton
Public. R. Falley, supv.
Total enrolment: 2,200
Technician enrolment: 200
Accreditation: NWA
Automotive technology*, aviation electronic technology, civil technology, civil and construction technology, electronic data processing technology, drafting technology, electrical technology*, electromechanical technology*, electronics technology, industrial electronic technology, drafting and tool design, machine drafting and design, machine tool technology, mechanical design technology, mechanical technology, metallurgical technology*, instrumentation, nucleonics, printing and photo engraving technology

SEATTLE PUBLIC SCHOOLS, ADULT AND VOCATIONAL EDUCATION DIVISION,
815 Fourth Avenue, N., Seattle

Public. T. J. Gilligan, asst. supt.
Total enrolment: 2,000
Technician enrolment: 322
Accreditation: NWA, State Ed. Dept.
Admission: 18 yrs. of age or high-school graduation
Aviation electronic technology**, electronic data processing technology**, drafting technology**, architectural drafting technology*, electrical technology**, electronics technology**, industrial electronic technology**, machine drafting and design*

Skagit Valley College, Mt. Vernon
Public. G. Hodson, pres.
Total enrolment: 3,925
Technician enrolment: 785
Accreditation: NWA
Admission: High-school graduation
Automotive technology, civil technology**, civil and construction technology**, drafting technology, electrical technology*, electronics technology**, metallurgical technology, instrumentation*, power technology

Spokane Community College, E. 3403 Mission, Spokane
Public. Walter S. Johnson, pres.
Total enrolment: 1700
Accreditation: State Ed. Dept.
Admission: High-school graduation or equivalent
Airconditioning and heating technology*, aeronautical technology**, aviation electronic technology**, electronic data processing technology**, drafting technology**, architectural drafting technology**, electronics technology**, industrial electronic technology**, instrumentation, printing and photoengraving technology**

Tacoma Vocational-Technical Institute, 1101 South Yakima Ave., Tacoma
Public. L. H. Bates, adm. dir.
Total enrolment: 11,431
Technician enrolment: 1,100
Accreditation: State Ed. Dept.
Admission: High-school graduation or equivalent, entrance examinations, personal interviews and previous school records
Airconditioning and heating technology*, civil technology**, civil and construction technology**, electronic data processing technology**, drafting technology**, architectural drafting technology**, electronics technology**, industrial electronic technology**, industrial technology*, drafting and tool design**, machine drafting and design**, mechanical design technology**, mechanical technology**, instrumentation**, nucleonics

WEST VIRGINIA

Bluefield State College, Bluefield
Public. L. B. Allen, pres.
Accreditation: NCA
Total enrolment: 700
Technician enrolment: 50
Architectural engineering technology, electronics engineering technology, civil engineering technology, mechanical engineering technology

Fairmont Senior High School, 8th St., Fairmont
Public. E. W. Malcolm, prin.
Total enrolment: 1,250
Technician enrolment: 31
Accreditation: NCA, State Ed. Dept.
Admission: 1 yr. of algebra, IQ 110 or more, pass entrance exam
Electronics technology

Huntington East High Vocational-Technical School, 2800 5th Ave., Huntington
Public. D. W. Fox, dir.
Total enrolment: 300
Technician enrolment: 15
Accreditation: NCA, State Ed. Dept.
Admission: High-school graduation
Electronics technology, industrial electronic technology

Logan High School, Logan
Public. C. W. Juergensmeyer, prin.
Total enrolment: 1,822
Technician enrolment: 56
Accreditation: NCA
Electronics technology

McKinley Vocational High School, 17th and Jacobs Street, Wheeling
Public. R. E. Potter, prin.
Total enrolment: 196
Technician enrolment: 40
Electronics technology

Parkersrurg High School, 2101 Dudley Avenue, Parkersburg
Public. H. W. Calendine, dir.
Total enrolment: 3,019
Technician enrolment: 44
Accreditation: NCA
Electronics technology**

Raleigh County Vocational Technical Center, 229 2nd Street, Beckley
Public. J. D. Robinson, dir.
Total enrolment: 459
Technician enrolment: 24
Admission: 1 yr. of algebra. Not less than 65 percentile on aptitude tests
Drafting technology*, electronics technology*

St. Albans High School, St. Albans
Public. B. Liggett, prin.
Total enrolment: 1,360
Technician enrolment: 36
Accreditation: NCA
Chemical technology

West Virginia Institute of Technology, Montgomery
Public. L. C. Nelson, pres.
Total enrolment: 1,150
Technician enrolment: 70
Accreditation: NCA
Admission: High-school graduation and rank in upper ¾ of class
Electrical technology

West Virginia State College, Institute
Public. W. J. L. Wallace, pres.
Total enrolment: 2,502
Technician enrolment: 91
Accreditation: NCA
Admission: High-school graduation
Building construction technology, architectural and mechanical drafting, printing and photoengraving technology

WISCONSIN

Appleton Vocational-Technical and Adult School, Appleton
Public. C. G. Bertram, dir.
Total enrolment: 4,100
Technician enrolment: 275
Accreditation: State Ed. Dept.
Admission: High-school graduation plus entrance exam.
Electronic data processing technology**, automotive technology**, drafting technology**, electrical technology**

Beloit Vocational-Technical and Adult School, Beloit
Public. R. A. Oster, dir.
Admission: High-school graduation or equivalent
Airconditioning and heating technology*, civil and construction technology*, drafting technology, electrical technology*, electronics technology**, drafting and tool design*, machine drafting and design, machine tool technology*, mechanical design technology**, mechanical technology*, metallurgical technology*, chemistry-physics technology

Cudahy Vocational-Technical and Adult School, Cudahy
Public. G. Hirsch
Electronics technology*

Fond du Lac Vocational-Technical and Adult School, Fond du Lac
Public. H. J. Van Valkenburg, dir.
Total enrolment: 300

Technician enrolment: 130
Admission: High-school graduation
Automotive technology**, airconditioning and heating technology*, civil and construction technology*, architectural drafting technology*, mechanical technology

EAU CLAIRE VOCATIONAL-TECHNICAL AND ADULT SCHOOL, Eau Claire
Public. W. L. Enge, dir.
Electronics technology**, mechanical technology

GREEN BAY SCHOOL OF VOCATIONAL AND ADULT EDUCATION, 200 S. Broadway, Green Bay
Public. W. W. Haubenschild, dir.
Total enrolment: 5,000
Technician enrolment: 150
Accreditation: State Ed. Dept.
Admission: High-school graduation
Automotive technology*, civil technology**, civil and construction technology**, electronic data processing technology**, drafting technology**, architectural drafting technology**, electrical technology*, industrial electronic technology*, mechanical design technology**, mechanical technology*, printing and photoengraving technology*

JANESVILLE VOCATIONAL-TECHNICAL AND ADULT SCHOOL, Janesville
Public. O. Johnson, dir.
Electronics technology*

KENOSHA VOCATIONAL-TECHNICAL AND ADULT SCHOOL, Kenosha
Public. E. Lehrmann, dir.
Technician enrolment: 500
Accreditation: State Ed. Dept.
Admission: High-school graduation or equivalent
Electronic data processing technology**, machine drafting and design**, fluid power technology**

LA CROSSE VOCATIONAL-TECHNICAL AND ADULT SCHOOL, La Crosse
Public. A. F. Jordan, dir.
Mechanical technology

MADISON VOCATIONAL-TECHNICAL AND ADULT SCHOOLS, Madison
Public. N. P. Mitby, dir.
Total enrolment: 12,000
Technician enrolment: 400
Accreditation: State Ed. Dept.
Admission: "C" average, high-school graduation, average intelligence or above
Automotive technology**, civil technology**, electronic data processing technology**, electronics technology**, printing and photoengraving technology**, mechanical design technology**

MANITOWOC VOCATIONAL-TECHNICAL AND ADULT SCHOOL, Manitowoc
Public. J. C. Ausman, dir.
Mechanical technology*

MILWAUKEE INSTITUTE OF TECHNOLOGY, Milwaukee
Public. G. A. Parkinson, dir.
Total enrolment: 5,914
Technician enrolment: 1,270
Accreditation: NCA
Admission: High-school graduation or those whose eligibility has been determined by the evaluation of previous work experience, education, and an entrance examination
Automotive technology, airconditioning and heating technology, civil and construction technology**, electronic data processing technology**, architectural drafting technology**, electrical technology*, electronics technology**, machine drafting and design, mechanical design technology, metallurgical technology, instrumentation, printing technology, chemical technology, diesel technology, fluid power technology

MILWAUKEE SCHOOL OF ENGINEERING, 1025 N. Milwaukee St., Milwaukee
Private. K. O. Werwath, pres.
Total enrolment: 1,824
Technician enrolment: 631
Admission: High-school graduation or equivalent, units in math and science
Airconditioning and heating technology†, computer technology, electrical technology†, electronics technology†, industrial technology†, metallurgical technology†, chemical production technology, fluid power technology, internal combustion engines

OSHKOSH VOCATIONAL, TECHNICAL AND ADULT EDUCATION, 228 Algoma Blvd., Oshkosh
Public. W. M. Sirek, dir.
Total enrolment: 15,000
Technician enrolment: 150
Accreditation: State Ed. Dept.
Admission: High-school graduation
Electronics technology, mechanical technology

RACINE VOCATIONAL-TECHNICAL AND ADULT SCHOOL, Racine
Public. H. M. Heigl, dir.
Total enrolment: 8,000
Technician enrolment: 300
Accreditation: State Ed. Dept.
Admission: High-school graduation or equivalent, 1 yr. high-school algebra, 1 yr. chemistry or physics
Electronic data processing technology*, drafting technology**, electrical technology*, electronics technology**, industrial electronic technology**, industrial technology**, drafting and tool design*, machine drafting and design*, machine tool technology*, mechanical design technology**, mechanical technology**, metallurgical technology*, instrumentation*, industrial maintenance**

SHEBOYGAN SCHOOL OF VOCATIONAL, TECHNICAL, AND ADULT EDUCATION, 843 Jefferson Avenue, Sheboygan
Public. F. J. Nierode, dir.
Total enrolment: 3,928
Technician enrolment: 80
Accreditation: State Ed. Dept.
Admission: High-school graduation or equivalent
Automotive technology, electronics technology, mechanical design technology, printing and photoengraving technology

STURGEON BAY VOCATIONAL-TECHNICAL AND ADULT SCHOOL, Sturgeon Bay
Public. C. P. Habermann, dir.
Mechanical technology*

SUPERIOR VOCATIONAL-TECHNICAL AND ADULT SCHOOL, Superior
Public. S. L. Lavine, dir.
Total enrolment: 1,100
Technician enrolment: 70
Accreditation: State Ed. Dept.
Admission: High-school graduation
Automotive technology, electronics technology

TWO RIVERS VOCATIONAL-TECHNICAL AND ADULT SCHOOL, Two Rivers
Public. C. Mayer, dir.
Total enrolment: 1,507
Technician enrolment: 77
Accreditation: State Ed. Dept.
Admission: High-school graduation
Electronics technology, industrial technology**, machine drafting and design**, hydraulics*

WAUKESHA VOCATIONAL-TECHNICAL AND ADULT SCHOOL, Waukesha
Public. A. J. Natalizio, dir.
Total enrolment: 3,200
Accreditation: State Ed. Dept.
Admission: High-school graduation
Drafting technology, architectural drafting technology, electrical technology, electronics technology, drafting and tool design, machine drafting and design, machine tool technology, mechanical technology

WAUSAU VOCATIONAL-TECHNICAL AND ADULT SCHOOL, Wausau
Public. L. B. Hoyt, dir.
Total enrolment: 600
Technician enrolment: 450

Accreditation: State Ed. Dept.
Admission: High-school graduation
Automotive technology**, electronic data processing technology**, drafting technology**, architectural drafting technology**, electronics technology**, mechanical design technology**

West Allis Vocational-Technical and Adult School, West Allis
Public. V. H. Schmitt, dir.
Admission: High-school graduation
Mechanical technology*

Wisconsin Rapids Vocational-Technical and Adult School, Wisconsin Rapids
Public. E. Everetts, dir.
Electronics technology*

WYOMING

Casper College, Casper
Public. T. H. Aley, pres.
Total enrolment: 725
Technician enrolment: 16
Accreditation: NCA
Admission: High-school graduation or over 21 yrs. old with completion of GED tests
Electronics technology

ADDENDA

Orange County Vocational School, 325 N. Palmetto Ave., Orlando
Public. J. R. Leach, prin.
Total enrolment: 700
Technician enrolment: 300
Accreditation: State Ed. Dept.
Admission: Standard vocational
Automotive technology, aeronautical technology, drafting technology, architectural drafting technology, electrical technology*, electronics technology**

Tampa Technical Institute, 315 Jackson St., Tampa
Private. E. Begue, pres.
Total enrolment: 35
Technician enrolment: 35
Accreditation: State Ed. Dept.
Admission: High-school graduation
Drafting technology, electronics technology, industrial electronic technology, industrial technology

Section 3

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1963 Developments on the Federal Level

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Technician Education Developments on the Federal Level in 1963

By Theodor Schuchat

**Washington Educational Correspondent,
Prakken Publications, Inc.**

FOR nearly a decade, organizations of post-high-school institutions have vied with organizations of vocational educators for the right to hold the nozzle that would spray federal funds across the country for the training of technicians. Enactment of the National Defense Education Act in 1958 placed the new $15 million nozzle firmly in the hands of vocational education, since Title VIII of that landmark legislation required area vocational education programs (for the "training of highly skilled technicians") to have the approval of state boards of vocational education.

The post-high-school educators, however, remained convinced that technician education should be available only at the college level and that federal funds should go directly to both public and private nonprofit higher educational institutions, rather than only to public institutions and only through state vocational education boards in support of "less-than-college-grade" courses. In October, 1958, they persuaded the Engineers' Council for Professional Development to decline to accredit any Title VIII programs, on the grounds that "less-than-college-grade" courses—as required by the vocational education legislation—could not possibly be "college-level" courses and thus could not qualify as ECPD-accredited technical institute programs. Vocational educators, on the other hand, argued that "less-than-college-grade" meant only that their offerings did not lead directly or indirectly to a bachelor's degree.

As Title VIII programs were started under the legislation as enacted by Congress and further defined by the regulations of the U.S. Office of Education, both vocational educators and engineering and technical institute educators composed their differences to some extent. In October, 1960, the ECPD changed its position and began to accredit some of the programs supported by federal vocational education funds.

The USOE's Division of Vocational Education, through its new Area Vocational Education Branch, identified Title VIII offerings as *technical* education, to distinguish them from the usual vocational education programs. On April 1, 1962, the Office of Education renamed this unit the Division of Vocational *and Technical* Education, and on October 17, 1962, the Area Vocational Education Branch became the *Technical Education* Branch. Yet a Professional *and Technical* Education Section was also established in the Division of Higher Education, indicating that this Division had by no means relinquished its claims to leadership in the field of technician education.

In January, 1962, a bipartisan group of Congressmen headed by Rep. John Brademas (D-Ind.) unanimously recommended to the House Education and

Labor Committee that the best way to meet the nation's growing requirements for "semiprofessional technicians" would be to expand college-level programs. Title VIII programs, because they were less-than-college grade, the Congressional group reported, were "unsuited to the production of semiprofessional technicians at the college level."

H.R. 10396 and companion bills were introduced by Rep. Brademas and other key members of the House Committee. Under the Brademas bill, up to $40 million per year for five years would go to state higher education agencies for two-year technical education programs that were accredited by a national or regional accrediting agency. High-school graduation would be required of these students, and public and other nonprofit higher educational institutions would qualify for federal support, in accordance with an approved state plan.

At hearings on the Brademas bill, the American Vocational Association contended that the need for more technicians could be met by providing more funds for Title VIII programs and removing the "less-than-college-grade" phrase from the original legislation.

The Under Secretary of Labor, who later became Secretary, W. Willard Wirtz, requested enactment of the Brademas bill at "this session" because of the need "to move on all fronts." The U.S. Commissioner of Education, Sterling McMurrin, agreed that additional federal action was needed to get more technicians prepared, but noted the success of Title VIII programs, and preferred to await the report of the President's Panel of Consultants on Vocational Education before taking a position on the pending legislation. Dr. McMurrin also called for legislation which would assure use of all available resources of both higher and vocational education for the preparation of technicians. The 87th Congress took no further action.

Preparing for the 88th Congress, the legislative committee of the National Society for Professional Engineers held several meetings late in 1962 in an effort to develop a bill that would attract more support. The American Vocational Association, the American Association of Junior Colleges, and the American Society for Engineering Education were represented, as well as the Office of Emergency Planning, Executive Office of the President, and the USOE's assistant commissioners for vocational and technical education, higher education, and legislation and program development.

These meetings only emphasized differences in beliefs about the proper level and location of technician-education programs. There was some recognition by each of the "opposing" interests—public vocational education *vs.* public and private nonprofit engineering and technical institute education—that the other source was capable of producing technicians of good quality. But neither was prepared to leave the field exclusively to the other, nor was it possible to achieve a satisfactory legislative compromise.

The report of the President's Panel of Consultants on Vocational Education, which was released in summary form on November 27, 1962, recommended $50 million "immediately" for full-time, post-high-school programs, or more than three times the amount appropriated annually under Title VIII, and proposed that these funds, which would be limited to public institutions, be made available for construction of teaching facilities. "As the NDEA is continued or replaced with other federal acts," the Panel also stated, "the emphasis should be on expanding the opportunities for technician education; the administrative auspices may be left to the decision of the individual states."

The omnibus education bill submitted to the 88th Congress on January 29, 1963, by President Kennedy contained provisions comforting each of the contending viewpoints in technician education.

Part C of Title II of the proposed National Education Improvement Act of 1963 (H.R. 3000 and S. 580) would have authorized $20 million for the fiscal year 1964 for two-year, college-level programs to educate semiprofessional technicians in the engineering, science, and health occupations. Both public and private nonprofit institutions would have been eligible.

This provision, the Administration's version of the Brademas bill, differed from the prototype in several respects. For example, the Brademas bill, which was reintroduced in the 88th Congress as H.R. 446, would authorize $40 million annually; however, the smaller appropriation proposed by the President was offset to some extent by the academic facilities construction features of his bill. More significantly, H.R. 3000 provided for approval of an institution's proposal directly by the Commissioner of Education, with no intervening state plan or state agency as would be required by the Brademas bill.

Testifying on this portion of the Administration's bills, U.S. Commissioner of Education Francis Keppel stated:

> Obviously . . . (Title VIII programs have made) an important contribution to the pool of available technical manpower, but it is not enough. In more than half the states, no higher institutions are training technicians in "less-than-college-grade" courses operated under the supervision of the state board of vocational education. Less than 10 percent of the 245 colleges which confer engineering degrees are participating in Title VIII technician-education programs. Clearly, the nation's higher institutions need an additional kind of program—the stimulation of federal funds as proposed in Title II-C in order to provide college-level preparation of engineering and other semiprofessional technicians.

The vocational education proposals contained in Part A of Title V of the Administration's National Education Improvement Act would have permitted Title VIII to expire, but the programs it supported could be expanded with the additional federal funds that the proposed NEIA would make available and with its removal of the requirement that federal funds be applied to training for specific occupational categories.

The hope of the Administration was that the NEIA would be considered by Congress as one omnibus bill. Initially, the Senate followed this approach with S.580. On the other hand, the House Education and Labor Committee, after considering H.R. 3000 for one month, divided it into small units for detailed public hearing on various portions of the complete bill.

Then Rep. Carl Perkins (D-Ky.) introduced H.R. 4955, the proposed Vocational Education Act of 1963, which contained the House Committee's proposals for vocational and technical education, signifying rejection of the Brademas bill as well as Title V-A of the NEIA.

Under H.R. 4955, Title VIII of the NDEA (which is actually on the statute books as Title III of the National Vocational Education Act, better known as the George-Barden Act) would become a permanent vocational-education program. The Perkins bill would also permit technician education at what is generally regarded as "college level" to be supported with federal vocational funds.

The bill would further broaden the previous legislation by permitting federal funds to be used for construction and initial equipping of area vocational schools; indeed, at least one-fourth of the additional funds that the Perkins bill would bring to each state would have to be used for this purpose or for training of persons who have completed or left high school and are available for full-time study.

The Perkins bill steers a middle course on the question of state administration. In nearly every state, the state board of vocational education is merely the state board of education under a different name. In many states, this board includes representation from institutions of higher education or has some jurisdiction over some of these institutions as well as the public schools.

The Perkins bill would reassure the colleges and technical institutes by requiring the state board for vocational education, as it prepares its state plan for approval by the USOE, to be advised by "one or more persons representative of junior colleges, technical institutes, or other institutions of higher education which provide programs of technical or vocational education . . ." If the state board does not include such individuals, as well as others representing management and labor, the board would be directed to create a special advisory council to comply with this provision of the bill.

The fiscal provisions of the Perkins bill are quite generous. To the present authorized annual appropriation of $67 million, the bill would add sums sufficient to result in total appropriations of $102 million for the first year after enactment, $147 million for the following year, $192 million for the next year, and $237 million for the next and all subsequent fiscal years.

The requirement that at least one-fourth of the additional federal funds be devoted to post-high-school courses would mean a minimum of $11.25 million more for these programs in the first year after enactment of the Perkins bill, $22.50 million in the second year, $33.75 million in the third year, and $45 million in the fourth and subsequent years.

After the Perkins bill had been approved by the House Education and Labor Committee, President Kennedy's civil rights message asked Congress to add

$63 million to each of the annual authorizations proposed by Rep. Perkins. The President also proposed that the mandatory 25 percent earmarking be raised to 40 percent.

As Congress spent the summer and fall debating the President's civil rights legislation, the Perkins bill languished in one of the many pigeonholes of the House Rules Committee, whose approval is almost always required if a bill is to be considered by the entire House of Representatives. Another pigeonhole held H.R. 6143, the Higher Education Facilities Bill, sponsored by Rep. Edith Green (D-Ore.)

While the Perkins bill would provide federal funds to support technician training *programs,* H.R. 6143 would provide federal funds to support *facilities* for technician training. Technical institutes and junior colleges are specifically identified in H.R. 6143 as institutions of higher education, and 22 percent of the federal funds for any year would be reserved for construction of academic facilities for public and other nonprofit junior colleges and technical institutes in each state. This amount—$50.6 million per year for three years—compares favorably with NEIA's $50 million for the first fiscal year after enactment and "such sums as may be necessary" for two succeeding years for grants to states for the construction of public community-junior colleges.

To summarize:

1. The Administration proposed *program* support for public and private nonprofit institutions of higher education; the Perkins bill proposes *program* support for public institutions only.

2. The Administration proposed that federal funds for junior college *facilities* go only to public institutions; the Green bill proposes that federal funds for two-year college *facilities* go to both public and private non-profit higher institutions.

All the bills would offer substantially greater federal funds for post-high school training of technicians.

At press time, Congress had not completed action on the 1963 education legislation and accompanying appropriations. Both the Perkins and Green bills were passed by the House of Representatives in August. Despite this action by the House, influential members of the Senate Labor and Public Welfare Committee, which handles education measures in the upper house, continued to favor the Administration's original proposals embodied in S. 580, which passed the Senate and was sent to conference committee.

Since the House had implicitly rejected the Administration's approach by enacting the Perkins and Green bills, however, many Senators feared that no education bill whatsoever would be enacted unless they approved a bill closely resembling—if not identical to—the House enactments. The outcome of the struggle between the vocational educators and the post-high-school institutions in regard to technician education remained in doubt, therefore, until the closing days of the Congressional session, late in the year.

Section 4

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Occupational Information

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Occupational Information about Technicians

ENGINEERING and science technicians make up one of the fastest growing occupational groups in the United States. In recent years, the needs of the nation's defense and space programs, added to those of an expanding and increasingly technical economy, have greatly intensified the demand not only for engineers and scientists but also for the technical workers who assist them. This report is concerned solely with those technicians who work with engineers and scientists. Draftsmen and surveyors, also usually considered technicians, are not included here nor are the technical occupations in the health field.

Nature of Work

There is no generally accepted definition for the term "technician." It has been used by different employers to refer to workers in a great variety of jobs, with many different job titles and requiring a wide range of education and training. In some cases, it has been applied to employes doing relatively routine work; in others, to persons performing work requiring skills within a limited sphere; and again to persons who do complex work of a highly technical nature as assistants to engineers and scientists. The workers' job titles may be descriptive of their technical level (for example, engineering technician, biological aide or junior engineer) or they may relate to the nature of the work done (for example, ceramic analyst, production analyst, tool designer, or time-study analyst). Some employers use the word "technician," preceded by adjectives such as mechanical, electrical, electronics, or chemical, which are descriptive of areas of technology in which personnel are employed.

As used here, the term "technician" refers to technical workers whose jobs require knowledge and use of scientific and mathematical theory and specialized education or training in some aspect of technology or science, and who, as a rule, work directly with scientists and engineers. In general, the jobs are technical in nature but more limited than those of the engineer or scientist, and have a greater practical orientation. Many of these technician jobs require the ability to analyze and solve engineering and science problems and prepare formal reports on experiments, tests, or other projects. Some require considerable aptitude in mathematics; others, the ability to visualize objects and to make sketches and drawings. Design jobs often require creative ability.

Many technician jobs require some familiarity with one or more of the skilled trades, although not the ability to perform as a craftsman. Still others demand extensive knowledge of industrial machinery,

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This report, which discusses the nature of the work of technicians in various areas, the training of technicians, and the employment outlook, is from the 1963-64 edition of the Occupational Outlook Handbook *(BLS Bulletin 1375), U.S. Department of Labor, Bureau of Labor Statistics.*

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tools, equipment, and processes. Some jobs held by these technicians are of a supervisory nature and require both technical knowledge and the ability to supervise people. Nearly all technician jobs, however, require the ability to communicate clearly, both orally and in writing.

In carrying out their assignments, engineering and science technicians frequently use complex electronic and mechanical instruments, experimental laboratory apparatus, and drafting instruments. Almost all of the technicians whose jobs are described here must be able to use engineering handbooks and computing devices, such as the slide rule or calculating machine.

Technicians work with engineers and scientists in virtually every aspect of engineering and scientific work. One of their largest areas of employment is research, development, and design work, in which they generally serve as direct supporting personnel to engineers or scientists. In the laboratory, they conduct experiments or tests; set up, calibrate, and operate instruments; and make calculations. They assist scientists and engineers in developing experimental equipment and models by making drawings and sketches and, under the engineer's direction, frequently handle certain aspects of the design work.

Technicians also work in jobs related to production, usually following a course laid out by the engineer or scientist, but often without close supervision. They may aid in the various phases of production planning, such as working out specifications for materials and methods of manufacture. Sometimes technicians devise tests to insure quality control of products, or make time and motion studies designed to improve production flow and the efficiency of particular work operations. They may also perform liaison work between engineering and production or other departments.

Technicians often do work that might otherwise have to be done by engineers. They may advise on installation and maintenance problems, serve as technical sales or field representatives of manufacturers seeking to aid contractors or customers in achieving maximum utilization of their technical products, or work as technical writers of specifications and manuals.

The following sections describe a number of areas of technology in which engineering and science technicians are trained and employed.

Aeronautical Technology. Technicians specializing in this area of technology work with engineers and scientists in many phases of the design and production of aircraft, helicopters, rockets, guided missiles, and spacecraft, and of propulsion systems, controls, and aircraft structures. Many of these technicians aid engineers in preparing layouts of aircraft and missile structures or equipment installations by collecting information, making calculations, and performing many other tasks. They work on projects involving stress analysis, aerodynamics, structural design, flight-test evaluation, weight control, or propulsion problems. For example, under the direction of an engineer, a technician might be assigned the problem of estimating weight factors, centers of gravity, and other items affecting load capacity of an airplane or missile. Other technicians working on engineering projects prepare or check drawings for technical accuracy, practicability, and economy.

Technicians sometimes help estimate the cost of the materials and labor needed to manufacture aircraft and missiles. They may also be responsible for liaison between the engineers who do the planning and development work and the workers who convert the engineers' ideas into finished products. As an airplane or missile is built, the liaison technician checks it for conformance with specifications, keeps the engineer informed as to progress, and investigates any production engineering problems that arise. He may recommend minor changes in the design, the materials used, or the method of fabrication, which would expedite production of parts or assemblies.

Other aeronautical technicians are employed as manufacturers' field service representatives, serving as the link between their employers and the military services, commercial airlines, and other customers. Technicians with a flair for writing and illustrative drafting often prepare instruction manuals, bulletins, catalogs, and other technical materials.

Air-Conditioning, Heating, and Refrigeration Technology. Technicians in this field often become specialists in one area of work, such as refrigeration, and sometimes in a particular type of activity, such as research and development, or design of layouts for heating, cooling, or refrigeration systems.

In the manufacture of air-conditioning, heating, and refrigeration equipment, technicians work in research and engineering departments, usually as aides to engineers and scientists. They may be assigned such jobs as devising methods for testing equipment or analyzing production methods. Technically trained personnel also assist in designing the air-conditioning, heating, or refrigeration systems for a particular office, store, or other location, and in preparing instructions for their installation. In designing the layout for an air-conditioning or heating system, they must determine the cooling or heating requirements, decide what kind of equipment would be best suited for the job, and estimate costs. Technical sales work for equipment manufacturers is still another area of employment for technicians. In such work, they must be able to supply contractors who design and install systems with information on such technical subjects as installation, maintenance, operating costs, and expected performance of equipment.

Chemical Technology. Technicians specializing in this area work mainly with chemists and chemical engineers in the development, production, sale, and utilization of chemical and related products and equipment. They apply their knowledge of the physical sciences and of apparatus and equipment to laboratory research or such work as the control of complicated chemical processes. The field of chemistry is so broad that chemical technicians often become specialists in the problems of a particular industry, such as food processing, or in a particular type of activity, such as quality control.

Most chemical technicians work in research and development, testing, or other laboratory work, assisting chemists, other scientists, or engineers. Those helping to conduct experiments may make the computations and tabulate and analyze the results. In testing work, technicians make chemical tests of materials to determine whether the materials meet specifications or whether particular substances are present and, if so, in what quantities. They may, for example, analyze steel for carbon, phosphorous, and sulfur content, or water for the amount of silica, iron, and calcium present. They also perform experiments to determine the characteristics of substances such as the specific gravity and ash content of oil. Technicians employed in research or testing laboratories often assemble and use such apparatus and instruments as dilatometers, interferometers, analytical balances, and centrifuges.

Outside the laboratory, chemical technicians are sometimes employed to supervise various operations in the production of chemical products and as technical salesmen of chemicals and chemical equipment.

Civil Engineering Technology. Technicians trained in this area assist civil engineers in performing many of the tasks necessary in the planning and construction of highways, railroads, bridges, viaducts, dams, and other structures. During the planning stage of a construction project, technicians may help in estimating costs, preparing specifications for materials, or participate in surveying, drafting, detailing, or designing work. Once the actual construction work has begun, they may assist the contractor or superintendent in scheduling construction activities or inspecting the work for conformance with blueprints and specifications.

Many persons trained in civil engineering technology become estimators, who prepare estimates of the costs, materials, and time necessary in the construction or repair of various structures. Some become highway inspectors, who may supervise the clearing of rights-of-way and the preparation of roads for surfacing, test materials used, and inspect construction work at various stages. Others are draftsmen, surveyors, or specialists in other well-established technical jobs.

Electronics Technology. This field includes radio, radar, sonar, telemetering, television, telephony, and other forms of communication; industrial measuring, recording, indicating, and controlling devices; navigational equipment; missile and spacecraft guidance and control instruments; electronic computers; and many other types of equipment using vacuum tubes and semiconductor circuits. Because the field is so broad, technicians generally become specialists in one area—for example, communications—and often in a subdivision such as radio or telephony. They may also specialize in some aspect of industrial electronics—for example, induction or dielectric heating, servomechanisms, automation controls, or ultrasonics.

Technicians working with engineers and scientists in the field of electronics need a strong background in electronics theory and mathematics to enable them to handle complex technical work above the level involved in routine operating and repair jobs. These electronics technicians may, for example, be assigned such tasks as preparing or interpreting layouts and other diagrams, developing and testing experimental electronic units, or assisting scientists and engineers in the design of electronic circuits. Their work often calls for use of engineering handbooks; oscilloscopes, signal generators, ohmmeters, multitesters, Q-meters, and other instruments; and computing devices, including slide rules.

Electronics technicians employed in research activities usually assist scientists or engineers in designing, testing, and modifying experimental electronic devices. They may be called on to devise practical solutions to problems of design, select suitable materials, determine the best method of building a piece of equipment, or test and evaluate the operating characteristics of the equipment after it is built. They may, sometimes, be assigned to make necessary modifications in experimental equipment.

Electronics technicians working with engineers in manufacturing operations may help in designing and setting up different types of testing equipment and devising quality control and other tests for manufactured products.

Electronics technicians may also be employed in special maintenance and repair jobs where a high degree of technical knowledge is needed. Electronics maintenance technicians employed by the Federal Aviation Agency, for example, are responsible for keeping radar and other electronic equipment in perfect working order for effective air traffic control. Persons with training and experience in electronics may be employed, also, as broadcast technicians in the engineering departments of radio and television broadcasting stations to operate and maintain the electronic equipment in the studio and at the transmitter.

Industrial Technology. Technicians trained in this area are sometimes called industrial technicians or production technicians. They assist industrial engineers on problems involving the efficient use of personnel, materials, and machines in the production of goods or services. Their work includes such tasks as preparing layout of machinery and equipment, planning the flow of work, and making statistical studies and analyses of production costs to eliminate unnecessary expense. The industrial technician may also assist the engineer by conducting time and motion studies, which involve timing and analyzing the movements workers make as they do their jobs.

In the course of their duties, many industrial technicians acquire experience which enables them to qualify for other jobs. For example, those expert in machinery and production methods may move into the field of industrial safety. Others who specialize in job analyses may become involved later in the setting of job standards and in the interviewing, testing, hiring, and training of personnel. Still others may move into production supervision.

Mechanical Engineering Technology. Mechanical engineering technology is a broad term which is sometimes used to cover a large number of specialized fields, including automotive technology, diesel technology, tool design, machine design, and production technology.

Technicians trained in one of the above areas of technology often assist engineers in design and development work by making freehand sketches and rough layouts of proposed machinery and other equipment and parts. Using engineering data and specifications and other available information, they help in determining whether a proposed product design change is practical and how much it will cost to produce. They may also be called on to apply their knowledge of mechanical engineering principles to solve particular design problems such as those involving tolerances, stress, strain, friction, and vibration.

Planning and carrying out tests on experimental machines and equipment for performance, durability, and efficiency is a large area of work for technicians. As part of the testing procedure, they record data, make computations, plot graphs, analyze results, and write reports. They sometimes make recommendations for changes in design to meet performance requirements. Their jobs often require the use of instruments, test equipment, and gages such as dynamometers, as well as the ability to prepare and interpret drawings.

Some workers with training in mechanical engineering technology are employed in manufacturing departments to help develop plans for testing and inspecting machines and equipment, or to work with engineers in eliminating production problems. Some obtain jobs as technical salesmen.

One of the better known specialties which may be grouped under mechanical engineering technology is that of *tool designer.* The tool designer designs tools and devices for the mass production of manufactured articles. He originates and prepares sketches of the designs for cutting tools, jigs, dies, special fixtures, and other attachments used in machine operations. He may also make detailed drawings of these tools and fixtures, or supervise others in making them. Besides developing new tools, designers frequently redesign tools currently in use to improve their efficiency.

In order to perform his highly technical job, the tool designer must have a knowledge of machine-shop practice and of drafting, and a good background in advanced algebra, geometry, and trigonometry. He must also be familiar with the characteristics of the materials of which tools and fixtures are made. In addition, he needs a knowledge of manufacturing procedures, and the advantages and disadvantages of various methods of production, so that he can design tools which will produce the article desired as efficiently and cheaply as possible.

Machine drafting with some designing is another major area of work which is often grouped under mechanical technology.

Other Areas of Technology. Many fields of work besides those described above offer opportunities for technicians with appropriate training. Those trained in *metallurgical technology,* for example, work with metallurgists and metallurgical engineers in processing metals and converting them into finished products. Their jobs may include testing of metals, minerals, ceramics, and alloys to determine their physical properties, or working in research laboratories on such projects as developing new ways of treating and using metals and alloys.

Technicians in the field of *mathematics* assist mathematicians, engineers, and scientists by doing computations involving the use of algebra, logarithms, trigonometric functions, and higher mathematics. Those working in the field of *biological technology* assist biological scientists in conducting tests and experiments to gain knowledge about living organisms and to apply this knowledge to the solution of practical problems, such as the development of new drugs and vaccines or new strains of plants. Those trained in *agricultural technology* work with agricultural scientists in improving farm products, the quality of foods, and soil conditions. Still other fields of work for technicians include: *cartography* (mapmaking), *forestry technology, electrical technology* (power), *gas turbine technology, optical technology,* and *petroleum technology.*

As industry becomes increasingly mechanized, new technical occupations continue to emerge. For example, *instrumentation technology,* a new and growing area of employment, has evolved from the introduction of more and more automatic controls and precision measuring devices in manufacturing operations. In industrial plants and laboratories, instruments are used to record data, to control and regulate the operation of machinery, and to measure time, weight, temperature, speeds of moving parts, mixtures, volume, flow, strain, and pressure. Technicians—who may have either specific training in instrumentation or training chiefly in electronics, mechanics, or hydraulics—work with the engineers and scientists who develop these highly complex devices, and with those who use them for research and development work.

Another new area of work for technicians, which has resulted from recognition of the need for a more scientific approach toward the reduction of industrial hazards, is *safety technology.* In the rapidly growing atomic energy field, in particular, technicians work with scientists and engineers on problems of radiation safety, inspection, and decontamination.

Where Employed

An estimated 535,000 engineering and science technicians, not including draftsmen and surveyors, were employed in 1962—about 12 percent were women. Approximately 400,000 of these technicians (about three-fourths of the total) were employed by private industry. The industries employing the largest numbers of engineering and science technicians are electrical equipment, machinery, chemicals, and aircraft, missiles, and spacecraft.

The federal government also employs sizable numbers of engineering and science technicians. In 1962, federal agencies employed nearly 70,000 employes in technician occupational categories; chiefly as engineering aides and technicians, electronic technicians, equipment specialists, cartographic aides, meteorological technicians, physical science technicians, soil conservation aids, forestry technicians, and mathematics aids. Of these engineering and science technicians, the largest number—nearly 30,000—worked for the Department of Defense. Together, the Departments of Agriculture, Commerce, and the Interior employed about 24,000 technicians, and the remainder were scattered among a number of other government agencies.

State government agencies employed about 40,000 engineering and science technicians in 1962, and local governments employed about 15,000. The remainder are employed by colleges and universities, mostly in university-operated research institutes, and by nonprofit organizations.

Training, Other Qualifications, Advancement

Young men and women who wish to prepare for careers as engineering and science technicians can obtain formal education for their work from a number of sources including technical institutes, junior colleges and community colleges, extension divisions of universities, colleges offering two-year technical programs, some large comprehensive high schools, technical high schools, and vocational-technical high schools. Many engineering and science students who have not completed all requirements for a bachelor's degree, as well as some other persons with post-high-school education in mathematics and sciences, are also able to qualify for technician jobs, providing they obtain some additional technical training and experience. Persons often become qualified for engineering and science technician jobs through on-the-job training and experience, plus formal course work taken on a part-time basis through either classroom or correspondence courses. In general, post-secondary-school technical training is required for high-level engineering and science technician jobs.

Engineering and science technicians usually begin work as trainees or in the more routine positions under the direct and constant supervision of an experienced technician, scientist, or engineer. As they gain experience, they are given more responsibility, often carrying out a particular assignment under only general supervision. Technicians may move into supervisory positions. Those with exceptional ability sometimes obtain additional formal training and are promoted to professional engineering positions.

The entrance requirements of schools specializing in preparing students for technical jobs are usually less rigid and standardized than those of four-year colleges. For admittance to institutions offering post-high-school technical training, high-school graduation is usually required. However, some schools will admit students without a high-school diploma if they are able to pass special examinations and otherwise demonstrate their ability to perform work above the high-school level. Since all the occupations considered in this chapter require basic training in mathematics and science, students interested in preparing for technical careers should obtain as good a background as possible in these subjects while in high school. A few technical institutes have arrangements for helping students make up deficiencies in these subjects.

Courses offered by schools specializing in post-high-school technical training are often of college level. Included is instruction in laboratory techniques, as well as courses in science, mathematics, and engineering, with subject matter related to the practical problems students will meet on the job. Students are taught the use of instruments and are also given instructions in the use of machinery and tools, more to give them a familiarity with the equipment than to develop skills.

Because of the variety of educational institutions where training may be obtained and the differences in the kind and level of training offered, persons seeking a technical education should use more than ordinary care in selecting a school. Information should be secured about accreditation, professional recognition, the length of time the school has been in operation, instructional facilities, faculty qualifications, acceptability of credits, and the kinds of jobs obtained by the school's graduates.

A brief discussion of some of the types of educational institutions and other sources where young people can obtain training as technicians follows.

Technical Institutes. Technical institutes offer one, two, or three years of education above the high-school level. Two years is the usual training period. Technical institute programs are usually specially designed programs having as their objective the placement of the graduate into some specific job or cluster of jobs immediately on graduation, and with a minimum of on-the-job training. The scope of these programs is more limited than that required to prepare a person for a career as a professional scientist or engineer. In general, the student receives intensive technical training but less theoretical and general education than is provided by four-year engineering and liberal arts colleges. Much emphasis is placed on laboratory and practical work in order to familiarize students with instruments, equipment, and techniques used in industry.

Some schools offer cooperative programs under which a student spends part of his time in school and part in employment related to the occupation for which he is preparing himself. It may take more than two years to complete the curriculum at a technical institute with a cooperative plan, but this type of program gives students valuable work experience, which often outweighs the disadvantages of a longer training period. In addition, students participating in cooperative programs frequently earn enough to pay for at least a part of their educational expenses, and are often able to obtain higher starting salaries on their first jobs.

Some technical institutes are operated as regular or extension divisions of colleges and universities. Others are separate institutions operated by states or municipalities, privately endowed institutions, and proprietary schools.

Evening as well as day sessions are available in most technical institutes. Almost half of the students attending technical institutes in 1960 were enrolled part time in evening and special classes. By attending evening classes, employed workers can often become qualified for technician jobs.

Some technical institutes give associate degrees, which signify that the student has completed at least two years of college-level work. If the prospective student desires eventually to obtain a bachelor's degree from a four-year college, he should investigate in advance whether his technical institute credits are transferable to the college of his choice.

Junior Colleges and Community Colleges. Many junior and community colleges also prepare students for technician occupations in industry and government. Two years of post-high-school education is usually offered by such schools and it is common practice for them to award the degree of associate in arts or science on completion of the two-year program.

Not all junior colleges are equipped to give technical training of the type described in this report. Some junior colleges offer courses equivalent to those given in the freshman and sophomore years of four-year colleges, in order that their graduates can go on into the junior year in a four-year college; others offer two-year terminal programs of the technical institute type.

Junior-college courses in technical fields are often planned around the employment needs of the industries in their locality. The training programs for prospective technicians, therefore, vary and may include highly specialized preparation in addition to general courses. In some cases, the courses are designed to meet the specifications of one or two industries or even of a single plant.

Many junior colleges are important adult education centers with extensive night-school programs. Through appropriate part-time study at junior colleges, as at technical institutes, workers may prepare themselves for engineering and science technician jobs.

Training in Industry. Some large corporations conduct training programs to meet their need for technically trained personnel. This type of training is primarily technical and rarely includes any general studies. Instruction is given both through formal classes and through training on the job. Workers who are trained wholly on the job generally get less theoretical background than those who receive formal instruction.

Other employers who are aware of the need for technically trained workers but do not have training programs, often encourage their employes to attend classes in local schools or to enrol in correspondence courses. Some large corporations reimburse their employes for tuition after they have completed courses satisfactorily. The workers are usually expected to take courses directly related to their work assignment, and are sometimes allowed to attend classes on the employer's time.

Training for some occupations in the technician category—tool designer and electronic technician, for example—may be obtained through a formal apprenticeship. In addition to on-the-job training, supplementary education in mathematics and science is provided. Persons interested in apprentice training may obtain further information from the local office of their state employment service, their state apprenticeship agency, the U.S. Bureau of Apprenticeship and Training, directly from employers, or the local labor union concerned with the occupation they wish to learn.

Other Training. Although most of the jobs considered in this report require post-high-school education or the equivalent in experience, a few advanced technical and technical-vocational high schools, principally in large cities, offer programs which qualify their graduates for some technician entry jobs. Graduates of this type of school, however, often need supplementary training before they can progress to higher level positions. In recent years, as a result of the stimulus provided by Title VIII of the National Defense Education Act of 1958, public schools of this type have been putting a great deal of emphasis on developing curriculums to qualify young people for entry jobs in technician occupations. Many technical high schools have high admission requirements and offer more thorough and advanced courses in mathematics, science, drafting, and laboratory work than are usually available in academic high schools. They sometimes offer an additional year of schooling beyond the 12th grade. Some schools have evening courses. These courses may be organized as formal technical programs to prepare technicians or may cover only a few subjects related to a particular area of work. Like other evening courses, they are designed especially for employed persons who wish to improve their job status by increasing their technical knowledge.

Correspondence schools offering home-study courses are an additional source of preparation for technicians. Success in such courses depends greatly on the ability of the student to study by himself. The persons deriving the most benefit from such courses are those who wish to learn more about their jobs or who wish to advance to a better job in the same field by increasing their theoretical and mathematical knowledge. Some correspondence-school programs also offer residence work in which the student receives laboratory and other practical training.

In addition to the sources of training already discussed, many thousands of technicians are trained each year by the armed forces. The Army, Navy, Air Force, Marine Corps, and Coast Guard all train their own specialists. Some trainees are given intensive short courses; others receive extensive training of a year or more. Much of the training is transferable from military to civilian jobs and many of the technicians trained by the military establishments utilize their training in civilian employment after they leave the armed forces.

Employment Outlook

Employment opportunities for well-qualified engineering and science technicians are expected to be very good throughout the 1960's, and continued expansion of the field is anticipated over the long run. In recent decades, technicians have been one of the fastest growing occupational groups, and there is every indication of continued rapid growth in these occupations. As the employment of scientists and engineers continues to grow, increasing numbers of technicians will be needed to assist them. In addition, more than 10,000 technicians will be needed each year to replace those who retire, die, or transfer to other occupations.

The demand for engineering and science technicians will be greatest in research, development, design, and other work preceding the manufacturing process. As products and the methods by which they are manufactured become more complex, increasing numbers of technicians will probably also be required to assist engineers in such activities as production planning, maintaining liaison between production and engineering departments, and technical sales work.

Underlying the increase in demand for technicians are the general expansion of American industry and the increasing complexity of modern technology. The demands of the defense and space programs will also result in a growing need for workers in the technician category. In addition, the trend toward automation of industrial processes and the growth of new areas of work, such as that related to atomic energy, will probably add to the demand for technical personnel.

Also of great importance to the expected growth in the employment of engineering and science technicians is the prospect of a continued high level of government and private expenditures for research and development in the years ahead. Expenditures for research for defense, and space programs in particular, are expected to continue at a high level. Furthermore, many companies are establishing new research programs and strengthening existing ones to meet the strong competition in developing new consumer-oriented products and processes.

Well-qualified women technicians should continue to have favorable opportunities, chiefly in drafting jobs, in chemical and other laboratory work, and in computation and other work requiring application of mathematics. Over the long run, it is likely that more women will be trained and find employment in these and other technician occupations.

In general, a technician's earnings depend on his education, his technical specialty, and his work experience. Other important factors which influence his earnings are the type of employer for whom he works, the kind of work he does, and the geographic location of his job.

Earnings

Annual starting salaries for graduates of post-high-school technical schools were typically between $3,700 and $5,700 a year in industry in 1962. Young persons entering engineering and science technician jobs with less formal training generally earned somewhat less.

In federal government agencies in early 1963, beginning engineering and science technicians were offered $3,820, $4,110, or $4,565, depending on the type of job vacancy and the applicant's schooling and other qualifications. Some federal government agencies hire high-school graduates and train them for technician jobs. Beginning salaries for these jobs ranged from $3,560 to $3,820 a year, depending on the individual's high-school courses and experience.

Most technicians can look forward to an increase in earnings as they gain experience. Information from studies of their graduates conducted by a number of technical schools in 1961 and 1962 showed most of the graduates earning over $6,500 a year after about five years of experience.

Employed Technicians Today -- and in 1970

By Theodor Schuchat

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STATISTICS, estimates, and extrapolations abound in the field of technician education. Recent data released by the National Science Foundation (NSF), however, appear to command a wide professional consensus as to their reliability, since they are chiefly grounded in the 1960 Census of Population.

NSF says there were 875,000 persons working as technicians in 1960,* of whom 17 percent were women. The comparable numbers earlier were 550,000 (1950 Census) and 300,000 (1940 Census). The 1963 year-end total is estimated by NSF at 1 million; the official estimate for the 1970 Census is 1.6 million. The nation started 1963, the NSF believes, with 955,000 technicians, plus or minus 10 percent. The net gain of 45,000 technicians during the year resulted from entry of 65,000 to the labor force and exit of 15,000.

Of the 875,000 persons working as technicians in the 1960 Census year, 40,000 were employed chiefly in research work, 200,000 in development work, 385,000 in production or operational activities, 15,000 in administration or management, 10,000 in teaching, and 225,000 in "other work." Industry employed 630,000 of these 875,000 technicians; federal, state, and local governments employed 155,000; colleges and universities employed 40,000; and 50,000 were employed elsewhere.

The Bureau of Labor Statistics has collaborated with the National Science Foundation to extrapolate some present data and trends to project the demand for technicians. Those trained in the health sciences are excluded from these calculations, except for the medical and biological technicians working with scientists and engineers in industry, government, research centers, etc. This exclusion shrinks the 1960 base number of technicians by 100,000 to 775,000.

To estimate the 1970 demand for technicians, the government statisticians developed trends in the ratio of technicians to scientists and engineers for each industry and then extrapolated these trends and applied them to their projections of the demand for scientists and engineers in 1970.

The Bureau of Labor Statistics and the National Science Foundation agreed on the following definition of a technician, for purposes of their statistical analysis:

"All persons engaged in work requiring knowledge of physical, life, engineering, and mathematical sciences comparable to knowledge acquired through technical institute, junior college, or other formal post-high-school training, or through equivalent on-the-job training or experience. Some typical job titles are: laboratory assistants, physical science aides, and electronic technicians. All employes in positions re-

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* EDITOR'S NOTE.—The figures cited in this article include draftsmen and surveyors, while the figures cited by the U.S. Department of Labor on page 61 do not.

Technicians, by Industry Group, 1960 Employment and Projected 1970 Requirements

(From National Science Foundation—Bureau of Labor Statistics)

Industry	1960 Employment		Projected 1970 Requirements	
	Technicians	Technicians per 100 scientists and engineers	Technicians	Technicians per 100 scientists and engineers
All Industries	775,100	67	1,296,800	66
Mining	10,600	34	14,000	34
Construction	32,700	59	63,300	59
Manufacturing	420,200	68	749,300	70
Food and kindred products	8,100	82	12,200	81
Textile mill products and apparel	4,700	81	5,400	82
Lumber and furniture	3,700	123	4,200	120
Paper and allied products	6,500	62	11,800	62
Chemicals and allied products	39,500	44	70,600	46
Petroleum refining and products of petroleum and coal	11,700	42	17,300	42
Rubber products	13,800	182	16,700	180
Stone, clay, and glass products	5,000	49	7,600	49
Primary metal products	17,900	51	29,100	51
Fabricated metal products and ordnance	37,800	99	94,100	99
Machinery	72,100	101	99,000	101
Electrical equipment	79,200	78	154,700	78
Aircraft, missiles, and spacecraft	49,000	46	107,000	55
Motor vehicles and equipment	24,500	69	36,400	69
Other transportation equipment	3,300	92	5,600	93
Professional and scientific instruments	21,300	81	41,800	81
Miscellaneous manufacturing	22,200	73	35,900	74
Transportation	10,700	91	16,000	91
Communication	30,400	125	38,400	116
Electric, gas, and sanitary services	16,800	66	19,000	66
Government	138,100	81	191,200	79
Federal government	61,400	62	93,800	62
State governments	48,700	119	60,100	119
Local governments	28,000	93	37,400	93
Colleges and universities	10,000	8	20,000	8
Other industries	105,600	105	185,600	104
Miscellaneous business services	7,300	94	20,300	93
Medical and dental laboratories	7,400	463	12,700	454
Nonprofit organizations	6,500	100	10,600	100
Engineering and architectural services	63,500	112	102,300	112
All other nonmanufacturing	21,000	76	39,700	76

Note.—Totals and percents are calculated on the basis of all significant digits and therefore may not correspond exactly with those indicated by the rounded figures shown.

quiring the indicated level of knowledge and training are included, regardless of job title and company department in which employed. Excludes craftsmen such as machinists and electricians."

Using this definition and the procedures outlined, the NSF-BLS forecast is that the number of technicians in the civilian economy will rise from 775,000 in 1960 to 1,296,700 in 1970. That's an increase of 521,700 during the decade, or 67.3 percent.

More than this number of technicians will need training during the decade, of course, due to deaths, retirements, transfers, etc. An average of 11,600 technicians are expected to die or retire each year of the 1960-70 decade. An average of 5,800 are expected to transfer to other work each year during this period. To offset these losses and yield the anticipated net increase of 521,700 from 1960 to 1970, it will be necessary to train a total of 695,800 technicians during the decade, or an average of 69,600 per year.

The present (1960) and projected numbers of technicians in various industries are shown in the table on the preceding page. More detailed data, including considerable information on post-high-school training, will soon be forthcoming from a sample survey of technicians at work in 1963 that is now being analyzed by the NSF-BLS statisticians.

Section 5

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Programs and Enrolments

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Programs and Enrolments in Technician Education

NEARLY 150,000 men, women, and school youth were enroled last year (1962) in 630 institutions offering technical training under Title VIII of the National Defense Education Act of 1958. This represents a three-fold increase since 1959, when the first programs began.

Forty-nine states, the District of Columbia, and Puerto Rico offered technical education programs in 1962.

Training is conducted under the direction of the state boards for vocational education in accordance with their respective state plans. Programs are offered in public schools including: vocational-technical schools, technical institutes, junior colleges, state universities, and secondary schools. Eighty percent of the larger public junior colleges—those with student enrolments of 1,000 or more—now provide technical education programs under the provisions of the Act.

Enrolments

Each year the largest enrolments have been in extension courses especially designed to upgrade the skills of adult technical workers presently employed. More than 95,000 persons took advantage of such courses in 1962.

In fiscal 1962, there were nearly 40,000 students in two-year post-secondary preparatory programs, an increase of more than 25 percent over the preceding year.

High schools enrolled about 13,000 students in technical programs.

Enrolments of women have risen steadily since 1959, from a meager 473 in that year to 6,820 in 1962. Between 1961 and 1962 alone, female enrolments increased 50 percent.

Programs

The most popular program in 1962 was electronics technology: enrolments totaled 78,000, including those in extension courses. Other technological fields included: mechanical design, electrical, chemical, metallurgical, civil and construction, electronic data processing, instrumentation, nucleonics, and plastics. Most of the female enrolees were in electronics or computer programing.

Federal funds for technical education programs have totaled $27,672,676 since the inception of Title VIII. The states, on a national average, have overmatched federal grants almost two to one. Federal funds have been used to match state and local expenditures for instruction, including salaries and equipment.

This report, from the Technical Education Branch, U.S. Office of Education, in June, 1963, covers only training programs under partial support from federal funds authorized by the Technician Education section of NDEA, Title VIII. These totals do not include many other programs in technician education that have not yet applied for or been granted support. Private technician training schools are also excluded from these totals.

I. ALLOTMENTS AND EXPENDITURES

Federal Funds	*Allotment*	*Released from Allotment*	*No. States*	*Added Allotment*	*No. States*
1959	$ 3,570,000	$ 584,126	20	$ 584,126	21
1960	7,000,000	620,607	12	620,607	18
1961	9,000,000	1,487,166	22	1,487,166	22
1962	12,800,000	2,818,994	23	2,700,980	21
1963	15,000,000	3,163,093[1]	18	3,163,093[1]	21

Total Funds Expended	*Federal*	*State*	*Local*	*Total*
1959	$ 2,745,995	$ 1,593,475	$ 3,479,156	$ 6,818,626
1960	5,968,137	2,925,395	5,132,997	14,026,529
1961	7,913,197	4,148,321	6,344,528	18,406,046
1962	11,042,875	5,456,967	8,106,010	24,605,851
Total	$27,670,204	$14,124,158	$23,062,691	$63,857,052
1963	$15,000,000*	$ 7,000,000*	$10,000,000*	$32,000,000*
Total	$42,670,204*	$21,124,158*	$33,062,691*	$95,857,052*

II. ENROLMENTS BY TYPE OF PROGRAM AND COURSE

	1959	*1960*	*1961*	*1962*	*1963*
Preparatory Programs					
Secondary	4,347*	8,467	11,778	13,028	15,000*
Post Secondary	14,896*	24,470	27,446	40,043	50,000*
Total Preparatory Programs	19,243	32,937	39,224	53,071	65,000*
Extension Courses (Total)	29,321	68,342	83,728	95,849	103,000*
Total Enrolment	48,564	101,279	122,952	148,920	168,000*

[1] June 15, 1963

* Estimated

Forty-seven states, the District of Columbia, and Puerto Rico reported graduates of full-time preparatory programs in 1962. A total of 9,946 students completed preparatory curriculums, an increase of 31 percent above 1961. Of these graduates, 2,247 (22.6 percent) continued formal education, while 678 (6.8 percent) joined a branch of the armed forces.

The excellent placement record of graduates illustrates the success of these programs in fulfilling the purpose of the Act. Of the 6,612 graduates available for placement, 5,523 (83.5 percent) were placed in the technical field for which they were trained or in a field related to their training. Those placed in nonrelated fields or whose status was unknown totaled 943 (14.3 percent). Only 146 (2.2 percent) were unemployed.

The average starting salaries paid to graduates of two-year post-secondary programs was $4,935 per year. The average for graduates of high-school programs was $3,830 per year.

III. NUMBER AND KINDS OF SCHOOLS

Kind of School	*Number of Schools* 1959	1960	1961	1962
Comprehensive High School	73	153	168	193
Vocational-Technical School	—	44	66	125
Technical High School	14	17	49	43
Vocational or Trade School	86	126	106	74
Technical Institute	17	52	25	27
Community or Junior College	38	119	126	129
Four-Year College	10	16	17	26
State Board for Vocational Education	20	2	13	13
Other	4	8	—	—
Totals	262	537	570	630

The Need for Educational Opportunities

The development of technical education programs at the post-secondary level has emphasized the need for public educational services through the 13th and 14th grades. The rising number of area vocational-technical schools—crossing school district boundaries, serving both youth and adults—testifies to the growing need for educational opportunities on a continuing basis.

Aided by the support of Title VIII, technician preparatory programs have increased from 351 in 1959 to 1,071 in 1962; extension programs have increased from 313 to 1,511 in this same four-year period. The machinery for program development is now well established. Excellent patterns have been set for both preparatory and extension programs. It is reasonable to expect that 1963 will again show substantial growth in technical educational services.

IV. KINDS OF SCHOOLS AND ENROLMENTS

	Preparatory Programs				*Extension Courses*				*Total Enrolments*			
Kind of School	*1959*	*1960*	*1961*	*1962*	*1959*	*1960*	*1961*	*1962*	*1959*	*1960*	*1961*	*1962*
Comp. H.S.	1,941	5,158	4,601	5,705	4,372	17,427	14,160	16,952	6,313	22,585	18,761	22,657
Voc.-Tech. Sch.	—	837	4,467	7,832	—	4,471	9,404	12,172	—	5,308	13,871	20,004
Tech. H.S.	1,224	2,634	5,968	5,568	3,735	6,970	8,494	11,567	4,949	9,604	14,462	17,135
Voc. or Tr. Sch.	5,000	10,585	6,404	3,886	12,993	14,015	8,896	7,813	17,993	24,600	15,300	11,699
Tech. Institute	2,987	2,193	1,828	5,892	3,980	3,387	9,547	4,079	6,977	5,580	11,375	9,971
Com. or Jr. Col.	5,841	8,987	13,743	22,258	3,306	19,914	28,844	37,356	9,147	28,901	42,587	59,614
Four-Year College	1,029	2,019	1,830	1,476	106	1,135	3,692	5,447	1,135	3,154	5,522	6,923
St. Bd. for Voc. Ed.	1,093	47	383	454	829	41	691	463	1,922	88	1,074	917
Other	128	477	—	—	—	982	—	—	128	1,459	—	—
Totals	19,243	32,937	39,224	53,071	29,321	68,342	83,728	95,849	48,564	101,279	122,952	148,920

V. Secondary and Post-Secondary Preparatory Program Enrolments by Kinds of Schools—Fiscal Years 1961 and 1962

Kind of School	*Secondary* 1961	1962	*Post Secondary* 1961	1962	*Total Enrolment* 1961	1962
Comprehensive High School	3,654	4,478	947	1,227	4,601	5,705
Vocational-Technical School	1,432	2,828	3,035	5,004	4,467	7,832
Technical High School	4,988	4,236	980	1,332	5,968	5,568
Vocational or Trade School	1,316	959	5,088	2,927	6,404	3,886
Technical Institute	108	97	1,720	5,795	1,828	5,892
Community or Junior College	250	356	13,493	21,902	13,743	22,258
Four-Year College	21	0	1,809	1,476	1,830	1,476
State Board for Voc. Educ.	9	74	374	380	383	454
Totals	11,778	13,028	27,446	40,043	39,224	53,071

VI. Number of Programs and Courses by Kinds of Schools

Kind of School	*Preparatory Programs* 1959	1960	1961	1962	*Extension Courses* 1959	1960	1961	1962
Comprehensive High School	54	160	114	159	86	255	269	329
Vocational-Technical School	—	23	89	234	—	72	133	248
Technical High School	28	29	113	129	21	58	88	179
Vocational or Trade School	132	175	133	107	124	209	181	145
Technical Institute	34	47	30	81	10	56	138	101
Community or Junior College	69	134	211	266	34	184	302	435
Four-Year College	14	20	33	26	3	34	72	60
State Board for Voc. Educ.	20	2	9	15	29	6	18	14
Other	—	8	—	—	6	31	—	—
Totals	351	598	732	1,017	313	905	1,201	1,511

VII. Preparatory Programs and Enrolments by Technologies

Technology	*No. of Programs* 1959	1960	1961	1962	*Enrolment* 1959	1960	1961	1962
Electronics	111	231	292	447	8,230	15,695	17,713	27,495
Mechanical	78	188	249	325	5,223	9,447	11,959	14,202
Electrical	30	68	73	81	1,697	3,410	4,043	4,918
Aeronautical	8	9	12	11	543	661	655	385
Chemical & Metallurgical	10	28	32	48	578	1,110	1,577	1,406
Civil & Construction	6	25	34	57	189	795	1,090	2,194
Instrumentation	3	17	13	20	44	992	829	808
Production	7	15	11	4	264	185	934	79
Data Processing & Computer Programing	—	8	11	19	—	63	298	1,439
Plastics	—	—	1	2	—	—	7	61
Other	38	9	4	4	2,475	579	119	84
Totals	291	598	732	1,018	19,243	32,937	39,224	53,071

VIII. EXTENSION COURSES AND ENROLMENTS BY TECHNOLOGIES

Technology	*No. of Courses* 1959	1960	1961	1962	*Enrolment* 1959	1960	1961	1962
Electronics	106	317	431	587	9,622	27,739	42,243	50,451
Mechanical	31	259	278	358	7,404	15,225	17,128	14,794
Electrical	22	67	109	84	1,102	3,726	4,825	3,779
Aeronautical	11	15	12	26	478	1,659	831	1,972
Chemical & Metallurgical	11	56	73	86	726	1,920	5,994	6,530
Civil & Construction	12	33	32	70	407	945	995	2,059
Instrumentation	23	32	43	43	342	1,123	1,781	2,324
Production	11	53	61	64	527	2,147	3,310	5,402
Data Processing & Computer Programing	—	61	141	174	—	12,626	5,693	7,656
Nucleonics	—	—	6	8	—	—	290	344
Plastics	—	—	3	6	—	—	201	338
Other	89	12	12	5	8,713	1,232	437	200
Totals	316	905	1,201	1,511	29,321	68,342	83,728	95,849

IX. FEMALE ENROLMENTS IN PREPARATORY PROGRAMS AND EXTENSION COURSES—FISCAL YEARS 1961 AND 1962

Technology	*Preparatory* 1961	1962	*Extension* 1961	1962	*Total Enrolment* 1961	1962
Electronics	127	539	1,496	2,065	1,623	2,604
Mechanical	156	129	508	467	664	596
Electrical	15	11	23	35	38	46
Aeronautical	1	0	15	59	16	59
Chemical & Metallurgical	50	121	68	91	118	212
Civil and Construction	4	13	10	22	14	35
Production	1	—	260	221	261	221
Data Processing and Computer Programing	119	538	1,734	2,391	1,853	2,929
Nucleonics	—	—	—	3	—	3
Plastics	—	—	—	6	—	6
Other	—	4	—	105	—	109
Totals	473	1,355	4,114	5,465	4,587	6,820

Section 6

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Placement and Salaries of Graduates

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Placement and Salaries of Graduates of Technician Education Programs

THE extent to which graduates are employed in the field for which they were trained is one effective means of evaluating occupational training programs. Recognizing this, the states have encouraged schools offering technical education programs under Title VIII of the National Defense Education Act of 1958 to make annual follow-up studies of graduates from these curriculums.

The first study was made of the graduating class for the academic school year 1960-61. This report presents the findings of state studies covering the graduating class of 1962.

Forty-seven states, the District of Columbia, and Puerto Rico reported graduates of full-time preparatory programs in 1962. A total of 9,946 students completed preparatory curriculums, an increase of 31

TABLE 1—GRADUATES FROM TECHNICIAN PREPARATORY CURRICULUMS AND PLACEMENT STATUS

	*Secondary School		*Post-Secondary School		Total			
	1961	*1962*	*1961*	*1962*	*1961*		*1962*	
Number of Graduates	1,897	3,515	5,699	6,431	7,596		9,946	
Not Available for Placement	750	1,295	1,274	2,039	2,024		3,334	
Number Continuing Their Education	548	920	646	1,327	1,194		2,247	
Number Entering Armed Services	175	245	503	433	678		678	
Other Reasons	27	130	125	279	152		409	
					1961	*Percent*	*1962*	*Percent*
Available for Placement	1,147	2,220	4,425	4,392	5,572	100.0	6,612	100.0
Placed in Field of Training	786	1,682	3,385	3,397	4,171	74.4	5,079	76.8
Placed in Related Field	118	155	365	289	483	8.5	444	6.7
Placed in Non-Related Field	67	141	291	271	358	7.2	412	6.3
Unemployed	16	53	99	93	115	2.0	146	2.2
Status Unknown	160	189	285	342	445	7.9	531	8.0

* Estimated. Graduates from secondary and post-secondary schools have not been separately reported by all states.

The figures on placement and salaries for 1961 and 1962 graduates are from the Technical Education Branch, U.S. Office of Education. They cover only graduates of technician education programs offered under Title VIII, National Defense Education Act of 1958. They do not include programs that are not operated with federal funds under Title VIII nor do they include private technical training schools. The information on 1963 graduates is from the American Association of Junior Colleges and the U.S. Department of Labor.

percent above 1961. Of these graduates, 2,247 (22.6 percent) continued formal education, and 678 (6.8 percent) joined the armed forces.

The excellent placement record of graduates illustrates the success of these programs in fulfilling the purpose of the Act. Of the 6,612 graduates available for placement, 5,523 (83.5 percent) were placed in the technical field for which they were trained or in a field related to their training. Those placed in nonrelated fields or whose status was unknown totaled 943 (14.3 percent). Only 146 (2.2 percent) were unemployed.

Placement by occupational fields was as follows: electronics—2,412; mechanical—1,542; civil and construction—260; electrical—244; production—208; chemical and metallurgical—158; all others—252.

The average starting salary paid to graduates of two-year post-secondary programs (as shown in Table 3) was $4,935 per year. The average for graduates of high-school programs was $3,830 per year.

The total earnings of the first two graduating classes (1961 and 1962) are estimated to have exceeded $70,000,000. This is more than the entire cost of the program so far, and would produce federal income-tax receipts equal to half of the federal government expenditures.

TABLE 3—SALARY RANGE BY TYPE OF SCHOOL FOR GRADUATES PLACED IN THEIR FIELD OF TRAINING

	Average		*High*		*Low*	
	1961	*1962*	*1961*	*1962*	*1961*	*1962*
Post Secondary	$4,600	4,935	$7,200	7,300	$3,200	2,700
Secondary	4,200	3,830	5,300	6,000	2,950	2,400
Both*	4,400	4,645				

* Average determined by dividing number of graduates into total salaries.

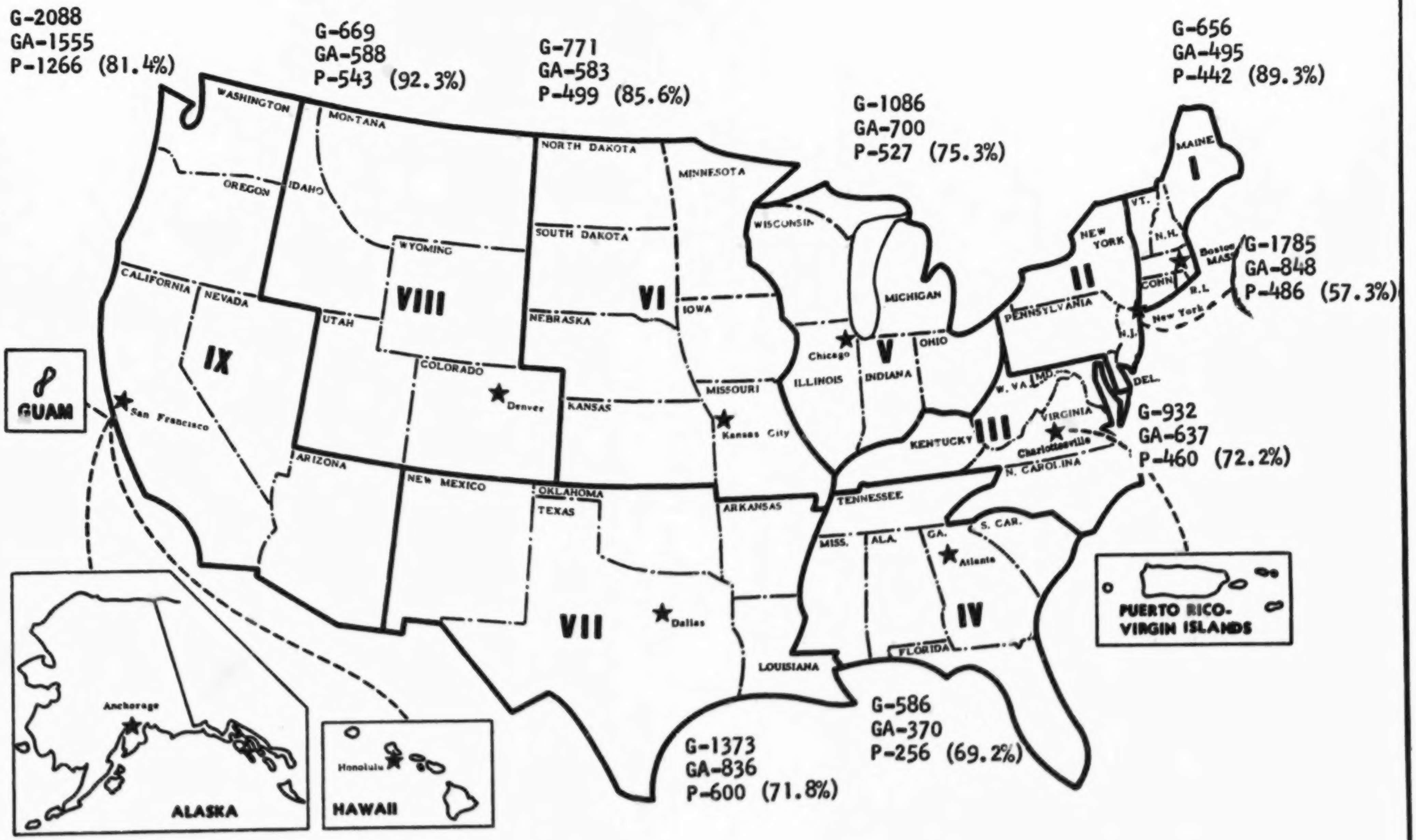
Chart A illustrates the number of graduates and placements by region. Region VIII, consisting of the states of Colorado, Idaho, Montana, Utah, and Wyoming, shows the highest percentage of placement with 92.3 percent (543 of 588 available graduates). Region I with 89.3 percent and Region VI with 85.6 percent follow.

The preparation of technicians in full-time preparatory programs, the results of which are the subject

TABLE 2—PLACEMENT OF GRADUATES AND SALARY RANGE BY OCCUPATIONAL FIELDS

Occupational Field	*Number Placed*		*Salary Range*					
			Average		*High*		*Low*	
	1961	*1962*	*1961*	*1962*	*1961*	*1962*	*1961*	*1962*
Aeronautical	—	$ 30	—	$5,870	—	$7,000	—	$3,205
Chemical and Metallurgical	—	158	—	4,190	—	5,350	—	3,000
Civil and Construction	363	260	$4,900	4,395	$6,500	5,700	$3,400	3,120
Data Processing and Computer Programing	152	77	4,600	4,210	5,900	7,000	3,500	2,700
Electrical	413	244	4,200	3,840	5,400	7,300	2,950	2,400
Electronics	1,667	2,412	4,400	4,840	5,500	6,230	3,300	2,995
Instrumentation	153	73	5,600	4,530	6,000	5,500	4,160	3,500
Mechanical	843	1,542	4,000	4,360	4,950	5,300	2,800	2,640
Production	265	208	4,200	4,275	6,550	5,790	3,200	2,815
N.E.C.	315	75	4,350	4,835	4,500	5,025	3,500	4,800
Total	4,171	5,079						

CHART A - GRADUATES AND PLACEMENTS BY REGIONS


G-2088
GA-1555
P-1266 (81.4%)
G-669
GA-588
P-543 (92.3%)
G-771
GA-583
P-499 (85.6%)
G-1086
GA-700
P-527 (75.3%)
G-656
GA-495
P-442 (89.3%)
G-1785
GA-848
P-486 (57.3%)
G-932
GA-637
P-460 (72.2%)
G-586
GA-370
P-256 (69.2%)
G-1373
GA-836
P-600 (71.8%)
I
II
III
IV
V
VI
VII
VIII
IX
WASHINGTON
OREGON
CALIFORNIA
NEVADA
IDAHO
MONTANA
WYOMING
UTAH
COLORADO
ARIZONA
NEW MEXICO
NORTH DAKOTA
SOUTH DAKOTA
NEBRASKA
KANSAS
OKLAHOMA
TEXAS
MINNESOTA
IOWA
MISSOURI
ARKANSAS
LOUISIANA
WISCONSIN
MICHIGAN
ILLINOIS
INDIANA
OHIO
KENTUCKY
TENNESSEE
MISS.
ALA.
GA.
S. CAR.
FLORIDA
N. CAROLINA
VIRGINIA
W. VA.
MD.
DEL.
PENNSYLVANIA
NEW YORK
N.J.
VT.
N.H.
MAINE
MASS.
CONN.
R.I.
San Francisco
Denver
Dallas
Kansas City
Chicago
Atlanta
Charlottesville
New York
Boston
GUAM
ALASKA
Anchorage
HAWAII
Honolulu
PUERTO RICO-
VIRGIN ISLANDS

G - Total number of graduates
GA - Number of graduates available for placement
P - Number of graduates placed in field of training
with percentage of graduates available for placement

of this report, is one of the two distinctly different technical educational services provided under Title VIII. Supplementary or extension courses for employed workers is the second one. The function of supplementary courses is to upgrade and update the technical knowledge and skills of employed workers to keep them abreast of rapid technological change.

A total of 95,783 workers participated in such supplementary courses in academic year 1961-62. This was an increase of 12,035 (14.4 percent) over the previous year.

Offerings reported for the school year 1961-62 under Title VIII included newly developed supplementary or extension courses in the fields of nucleonics, missile telemetry, stored programing, corrosion mitigation, mechanical and random vibrations, and cryogenics. One state reports that supplementary training programs provided for technical personnel enabled electronic petro-chemical and aircraft industries to fulfill work contracts.

Reports from the states show that many who have taken technician education extension courses have been provided with additional technical knowledge and skills that have increased their productivity and improved their economic status. Research is needed to provide additional data to show how many of these persons have retained employment status, received increases in pay, or received job promotions as a result of the completion of such courses.

The 1963 Picture

For the June, 1963, graduates of technical programs, the employment outlook also was bright, even though complete figures are not yet compiled.

The American Association of Junior Colleges reported in June that the demand for well-qualified graduates of many of the two-year institutions far exceeded the supply. For example:

- Joseph A. Amori, director of personnel placement service at the City College of San Francisco, said that there were more full-time career jobs in the San Francisco Bay area for two-year graduates with productive skills in such fields as electronics, chemistry, data processing, etc., than there were qualified people.
- Antelope Valley College in California reported 100 percent placement of its 1963 technical graduates.
- Everett Junior College in Washington reported that its two-year graduates would have little difficulty in finding jobs. The 1963 graduating class totalled 275 students, with 75 of them completing technical and semiprofessional training.
- All of the graduates of the technical school at Tyler Junior College in Texas had one or more offers before graduation in drafting, surveying, electronics, and petroleum technology, according to Forest Griffin, director of the school. All the technically-trained students were hired within a week after representatives of a number of Texas firms were invited to the campus early in the spring. Most of the 39 graduates were to go to work at $400 per month and could expect to climb to $700 monthly by the end of two years, Griffin reported.
- At Flint Junior College in Michigan, 70 percent of its 1963 graduates had been placed a month before graduation. All graduates of the technical programs could look forward to success in job hunting, according to Marie R. Prahl, director of guidance services at the college. She said that most in demand were mechanical, electronic, automotive, and technical laboratory technicians.
- Del Mar Junior College in Corpus Christi, Texas, reported that its technical program graduates had even received offers to teach in high schools at salaries as high as $5,300 for 10 months' assignments. However, those offered the high-school positions took what they considered better jobs in industry.

From another source, the U. S. Department of Labor, optimistic employment opportunities for 1963 graduates of junior colleges and technical institutes also were reported.

Job opportunities for engineering technicians trained in electronics, mechanical, chemical, metallurgical, and most other areas of technology are especially good, particularly if graduates are willing to relocate, Secretary of Labor W. Willard Wirtz announced in May.

The U. S. Department of Labor pointed out that recruitment of two-year graduates is conducted on a much less formal basis than for four-year graduates. Much of it is done by firms in the school's immediate area, with contacts made by telephone or letter. The principal exception is for well-trained engineering technicians, the demand for whom often brings employers from many areas to the better known technical institutes and other institutions which train these personnel. The salary offers to engineering technicians, the Department announced, are frequently in the $450-$475 a month range—higher than those averaged by some liberal arts and other graduates of four-year institutions.

Section 7

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Case Studies of Programs in Schools

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Training Electrical Technicians at Connecticut Technical Institutes

By Joseph T. Nerden

**Director, Division of Vocational Education,
State Department of Education,
Hartford, Connecticut**

WITH the growth of electrical technology and increasing uses for electricity in the manufacturing field, the electrical technology curriculum offered at the Connecticut state-operated, regional state technical institutes at Hartford and Norwalk has become one of the most popular and needed areas of study. This was particularly evident in the results of a study conducted in 1956 in Connecticut to determine the number of different classifications of technicians that were needed to man, operate, and expand Connecticut industry. It was found that of 2,600 technician positions then declared vacant, more than 900 were identified in the electrical and electronics areas. At the time, the findings more than justified the operation and continued expansion of the training in these areas as carried on since 1946 at the Hartford State Technical Institute and at Norwalk since 1961.

Further information, available to the State Department of Education through the offices of the State Labor and State Development Departments, continues to indicate rapid growth of the electrical and electronics industries and the establishment of many new industries in Connecticut because of the ready availability of training facilities for craftsmen and technicians.

In the technical institutes at Hartford and Norwalk, subject matter is not primarily concerned with manual skills, even though a background of manual skills may be valuable to the individual in understanding the subject matter. The instruction deals with skills of the mind rather than with those of the hands, and, for all practical purposes, the graduates of the electrical-technology curriculum from the technical institutes more nearly fit the classification of "engineering aide" than any existing definition. An examination of the curriculum (shown elsewhere with this article) indicates this.

General Education Minimized

Since the institutes are post-secondary, the instruction is comparable to that found in post-secondary engineering institutions. A close examination of the curriculum indicates the rather limited amount of general education that is included. Analyses have been made and much effort has gone into making the curriculum broader, to include a more varied selection of general subjects.

However, consulting committees, made up of more than a dozen individuals selected from labor and various phases of manufacturing in the electrical and electronics areas that work closely with the institutes, have indicated that, in order to include more courses of a general nature, courses that are highly technical and functional would have to be deleted. Because the committees have applied the test of "what is of most worth," the decision has been heavily in favor of the technical subjects which prepare the graduate for immediate employment in the industries of the state. Furthermore, the committees have always felt that of the two areas—general and technical—the graduate can more easily acquire the general education experience after graduation from the institutes.

The committees have worked long hours over a period of many months, meeting regularly to determine changes required with the technology. Each has worked on the outline and development of curriculum and has estimated the nature and cost of plant and equipment needed. It is interesting to note here that, although each committee has been and is currently involved in the production of ideas which have become and will become operating policy, it is always aware of the fact that the consulting committee is a device of the State Division of Vocational Education, and final decisions concerning state operating policy must be made by the State Board of Education.

A further examination of the curriculum reveals that electrical technology provides a broad background of technical information and experimentation within a cluster of positions held by technicians in the electrical field. It has never been the intent of the curriculum to provide highly specialized training for *individual* areas of the electrical field, because this would appear to hamper the employment of the graduate engineering aide. In place of a highly specialized course of instruction, the broadest possible training is offered in basic principles and essentials. Learning these mathematical, scientific, electrical, and electronic principles enables graduates to work efficiently in a number of technical jobs such as electrical cost esti-

ELECTRICAL TECHNOLOGY CURRICULUM

C—Class Hours *L*—Laboratory Hours *T*—Term Hours Credit

First Year

First Term	*C*	*L*	*T*
Tech. Math I	5	0	5
Tech. Drawing I	0	6	3
Metals Lab. I	0	3	1
Tech. Report Writing	3	0	3
Physics I	3	2	4
Electricity I	4	2	5
Physical Education	0	2	1
Total	15	15	22

Second Term	*C*	*L*	*T*
Tech. Math II	5	0	5
Tech. Drawing II	0	3	1
Physics II	3	2	4
Electricity II	4	2	5
General Chemistry I	4	2	5
Electrical Lab. I	0	3	1
Physical Education	0	2	1
Total	16	14	22

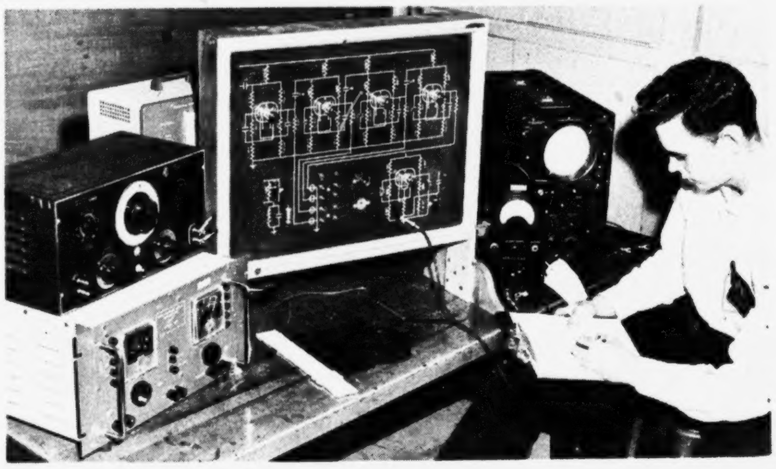
Third Term	*C*	*L*	*T*
Tech. Math III	5	0	5
Oral Communications	3	0	3
General Chemistry II	2	2	3
Electric Circuits I	4	3	5
D-C Machinery & Controls	3	3	4
Physics III	3	2	4
Total	20	10	24

Second Year

Fourth Term	*C*	*L*	*T*
Calculus I	4	0	4
Economics	4	0	4
Electric Circuits II	3	3	4
Electronics I	4	3	5
Electronics Lab. I	0	3	1
Materials of Engineering	4	0	4
Physical Education	0	2	1
Total	19	11	23

Fifth Term	*C*	*L*	*T*
Calculus II	4	0	4
A-C Machinery and Controls I	3	3	4
Electronics II	4	2	5
Electronics Lab. II	0	3	1
Electronics Circuits and Applications I	3	2	4
Elec. Measurements	4	0	4
Physical Education	0	2	1
Total	18	12	23

Sixth Term	*C*	*L*	*T*
Applied Math	2	0	2
Industrial Organization and Management	4	0	4
Human Relations	2	0	2
A-C Machinery and Controls II	3	3	4
Electronics III	4	3	5
Servo-Instrumentation and Control Lab.	0	3	2
Wave Analysis and Pulse Techniques	3	3	4
Total	18	12	23



The mathematics and science of electronic circuitry are given intensive treatment in the electrical technology program in the state's technical institutes.

mating, electrical drafting, electrical engineering aide, power-house load dispatching, power-house technician, sales technician, technical report writer, and others. Also, graduates are able to demonstrate efficient performance in the occupations of communications technician, laboratory technician, radio and television production supervisor, radio-communications maintenance, recording technician, television studio technician, and transmitter technician. Graduates have made excellent employment records in these jobs, and documented follow-up data is available in the offices of the two state technical institutes.

Applicants Screened

Since the aim of the electrical program is at the highest level of "technician," applicants and their qualifications are screened very carefully. During the spring of 1963, when graduates of high schools and vocational-technical schools in Connecticut were being interviewed for the September, 1963, class, it was evident that approximately one out of eight applicants would be accepted for enrolment. Acceptance is based on a satisfactory grade in the EPSAT (Engineering Physical Science Aptitude Test), a personal interview, an analysis of the applicant's high-school record, and the high school's recommendation filed with the institute counselor.

Success in the institute's program has never been successfully forecast, but it has been noted that satisfactory completion of high-school courses in physics, chemistry, and algebra is a practical and basic requirement. Yet, despite careful selection procedures, some dropouts occur and are inevitable. A few are the result of financial hardship, others are due to the changing industrial economy of Connecticut. During the past five years, approximately 60 percent of those who enrolled as freshmen completed the required two years of study and graduated.

Methods for selecting students for an institute have been, and continue to be, a matter of absorbing interest to the staff. The effectiveness of selections and the actual relationship between selection procedures and the success which a student achieves at the institute have been under continuous study. One detailed study by Frank L. Juszli, director of Norwalk State Technical Institute, indicates that of the several areas included in the EPSAT test, only two have any real bearing on the applicant's chances for success in the school. These are the mathematics and physics sections. It has been important to the institutes that the verbal comprehension and mechanical comprehension parts of the EPSAT test *appear to have less value* as screening devices of applicants than the other sections of the test. Study is continuing on the use of this test as a diagnostic and prognostic device for deciding which students should be admitted.

The objectives of the two-year electrical technician curriculum at the institutes stem from the philosophy that the program is essentially designed to prepare graduates for immediate employment. While no educational program should ever be classified "terminal," the main objective of the institutes' program is to provide industry with critically needed technicians. Despite the urgency of the task of the institutes, many of the graduates go on to higher education (more than 25 percent) and receive one and one-half years to two years of transfer credit. The credits transferred are

Students study in depth the characteristics of a-c and d-c machinery as a functional part of the electrical technology program in Connecticut.

individually determined by proven competence of the individual.

Constant Program Reevaluation

During its 17 years of operation, evaluation of the program of day-school instruction in electrical technology has had to be a continuing activity. Changing requirements for electrical and electronic technicians have been the result of scientific and technological change, and of the gradual shift of responsibility of the electrical engineer as he has moved more into the field of research and development.

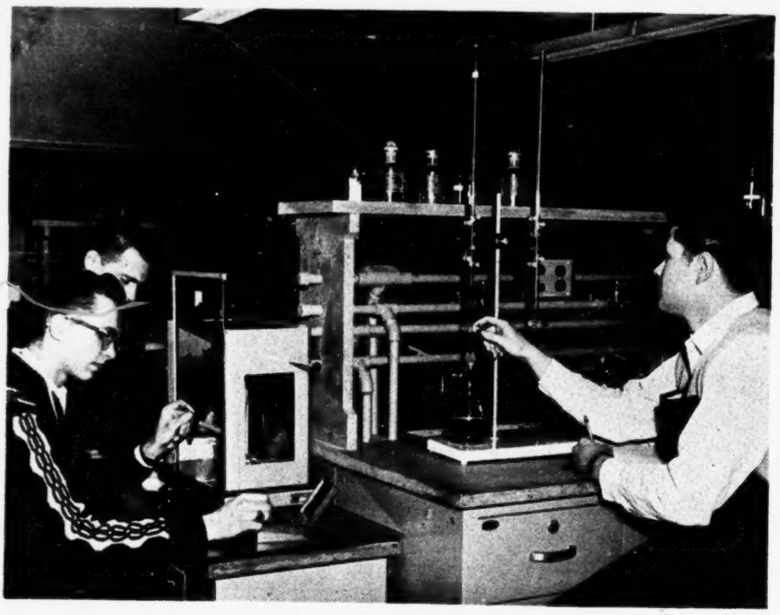
The accurate measurement of the program of instruction against the needs of the industry it strives to serve has never been constant long enough for studies over any considerable length of time to be definitive. However, several means for partial evaluation exist. They bear significantly on the effectiveness of the program and its potential for meeting state, personal, and industrial needs. Regular meetings with members of the institutes' consulting committees, collectively or individually, have resulted in frequent reevaluations concerning effective performance of graduates. This procedure has resulted in numerous modifications of the curriculum, redesign of laboratory activities, and improvement of teaching procedures. The most recent reevaluation of the curriculum took place in 1963, and the results submitted by a committee of industrial experts will provide the basis for extensive modification during the next two years.

Another valuable facet of the program evaluation consists of reactions obtained from personnel directors of major industries. These reactions are studied and contrasted with reactions of industrial department heads under whose supervision technicians work. Opinions and reactions concerning performance of graduates appear to be fulfilling needs of employing agencies. Further, since there are now four to six jobs available for each graduate of the electrical-technology curriculum, and if such demands can be taken as an indication of success, the program can be considered just that.

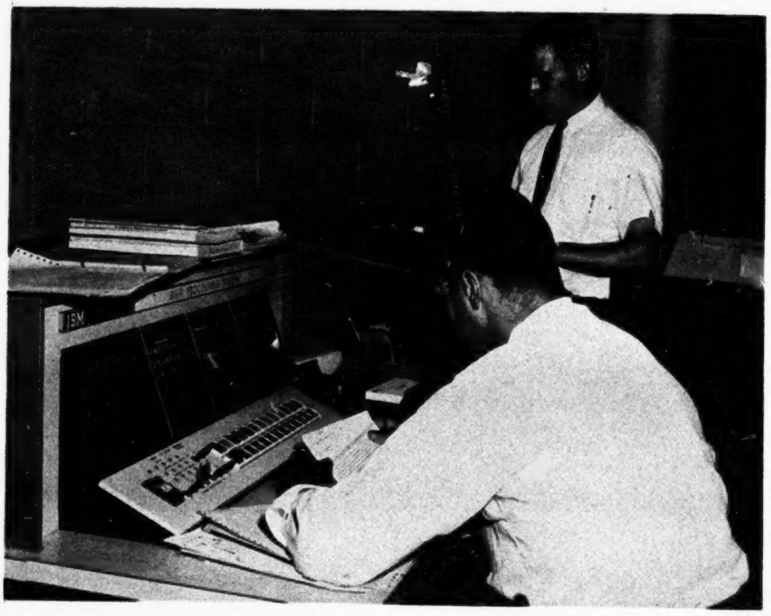
Since post-secondary technician training appears to be succeeding, further expansion of facilities for this type of training is being processed. In the 1959 Connecticut General Assembly, appropriations were received for the purchase of acreage, construction, and equipping of two additional state technical institutes. The Norwich State Technical Institute was in full operation as of September 1, 1963, and the Waterbury State Technical Institute should be in operation early in 1964. Studies are currently underway to determine the need for additional facilities in Hartford, Bridgeport, and central Connecticut. With its system of four operating state technical institutes, it is expected that day-school enrolments will accommodate 1,800 students and very nearly three times that number in the evening division.

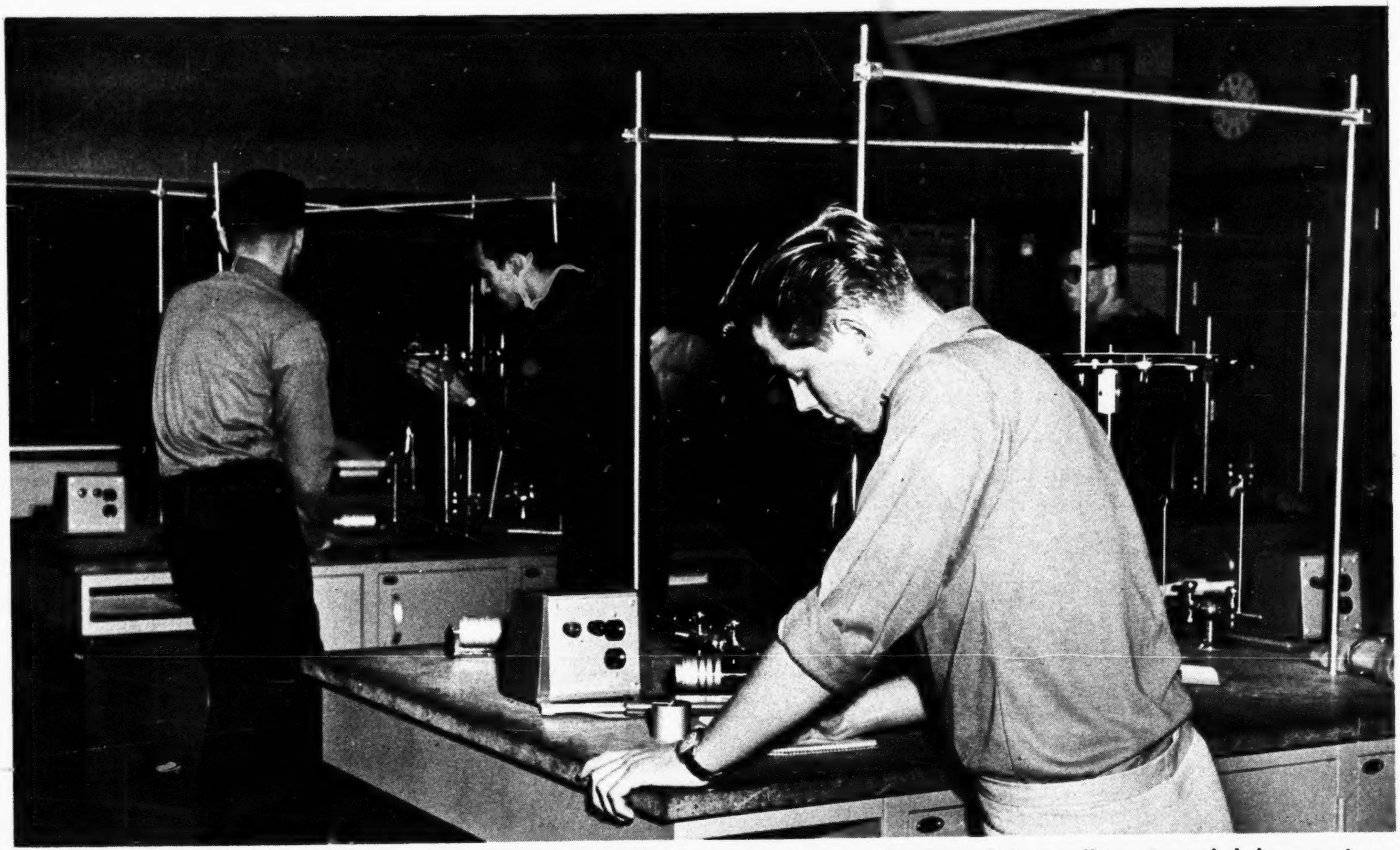
While the Hartford State Technical Institute is the only institution in the system that has been in operation over the required five years necessary for approval

Basic problems involved in chemistry and physical chemistry comprise an important portion of the core program of instruction for both upper and lower classmen.



All students in Connecticut's institutes receive instruction on modern data-processing equipment. Problems normally encountered in engineering are programed through the computers.





The common core of physics instruction in all of the technologies is offered in well-equipped laboratories.

of curriculums by the Engineers' Council for Professional Development (and currently enjoys the accreditation of E.C.P.D.), all of the curriculums in all of the institutes in the state-conducted system are pointing for immediate accreditation when the "term of operation" criterion has been met. The value of E.C.P.D. accreditation has been amply demonstrated in the successes achieved by graduates of the institutes, and accreditation by this engineering-oriented Council is highly prized.

Accreditation and approval for the institutes have also been given by the Council on Higher Education of the Connecticut State Department of Education, thereby enabling the institutes to award the degree of Associate in Applied Science to all who complete the two-year day curriculums and the five-year evening curriculums.

Evening Programs Popular

With the development of the technical-institute program in Connecticut, a parallel need for "evening technical institute" level of instruction became apparent. This program was necessitated by the need for employed personnel to have facilities for upgrading themselves to meet present opportunities as well as those opportunities that are still in the future. Consequently, of the 14 regional vocational-technical schools in Connecticut that operate a secondary level program of trade education, 12 are already involved in a five-year evening technical-institute program leading to a diploma and the degree of Associate in Applied Science. Nearly 3,500 students in mechanical, electrical, chemical, civil, and tool-and-production technology are matriculated. By far the greatest number is in the electrical technology curriculum.

Facilities and buildings that are in use daily from 8 A.M. to 3 P.M. and house the *secondary* level T & I programs are pressed into use and function in the *post-secondary* field of technical education from 4 P.M. to 7 P.M. and from 7 P.M. to 10 P.M. daily.

Courses offered within the electrical-technology curriculum are taught by engineers and other competent instructors drawn from the industries of the state and certified as instructors for areas they are responsible for teaching. The well-equipped physics, chemistry, and materials-testing laboratories used in the all-day secondary-school program are thus made to do double duty in the program offered in the evening technical institutes.

The shops are used on occasion to apply and to emphasize content of the technical courses, but since craftsmen skills are not the fundamental need of the electrical and electronic technician, the shops are of secondary importance. On the other hand, the laboratories and facilities for individual study, testing, and experimentation are complete with modern equipment and teaching facilities.

Enrolment and acceptance as a student in the degree-granting evening technical institute programs depends on evidence of high-school graduation supplied by the applicant, along with evidence of his satisfactory completion of required prerequisite courses in algebra, physics, and chemistry. The applicant must also have made a satisfactory score in the EPSAT test or its equivalent. As a further service to industries in the state and as an education opportunity for individuals, enrolment in specific unit courses in the evening technical institute program is facilitated by including such individuals in regular classes designed for those enrolled in the degree program. However, to maintain instruction at a consistently high level, these students receive prior counseling to determine readiness for instruction in the particular unit course. Students must be determined competent in prerequisite content before acceptance and matriculation are final.

With the growth of the institute system, and from the analyses of the several areas of Connecticut with regard to industrial expansion and job opportunities, it has become apparent that electrical and chemical technologies will enroll the greatest number of students. This is evident because of the concentration in Connecticut of electrical, electronic, nuclear, and chemical research and development.

Despite efforts toward expansion and development, Connecticut appears to have only just begun to meet the need for supplying electrical technicians for Connecticut industry. Encouraged by intense interest and active support of industrial leaders of the state, as well as by the public, the Division of Vocational Education expects to continue to expand its activity in the technician development program, consistent with the needs of Connecticut's industry.

Training Drafting Technicians at V. T. I., Southern Illinois University

A. Machine Drafting and Design Technology

By M. Keith Humble

Director, Vocational Technical Institute,
Southern Illinois University, Carbondale

THE Vocational Technical Institute, a department of the Division of Technical and Adult Education of Southern Illinois University, was established in the fall of 1952 to provide a college-level program of instruction of shorter duration than the usual four-year college programs, which would qualify students for employment at the semiprofessional and technician level in industry, office occupations, personal services, merchandising, and retailing. A combination of technical and general-education courses is included in each curriculum. The growth of the school has given evidence that this type of technician training fills a need for both employer and employe. As programs have been added, enrolment has grown. Thirty-seven students started in September, 1952; today, there are close to 900.

V.T.I. is located 11 miles east of the main campus in Carbondale at the site of the former Illinois Ordnance Plant, less than a mile from Crab Orchard Lake and five miles west of Marion. Buildings in the Illinois Ordnance Plant Administration area have been redesigned (and other buildings have been added) to accommodate students for instruction, food service, recreation, and housing.

The Institute offers three types of programs for high-school graduates. (Requirements for entrance are the same as those listed for general admission to the University.) They are:

1. Two-year curriculums in various phases of business and retailing leading to an Associate of Business degree.
2. Two-year curriculums in various technical fields leading to an Associate of Technology degree.
3. One-year certificate programs in bookkeeping-clerical, office machines, practical nursing, welding, cosmetology, stenography, and unit record keeping.

There are 14 associate-degree programs in technology: architectural drafting and design technology, automotive technology, building-construction technology, commercial art, dental-laboratory technology, dental hygiene technology, aviation technology, business data-processing technology, industrial and scientific data-processing technology, industrial-wood technology, machine drafting and design technology, machine tool technology, printing technology, and electronics technology.

Drafting Program Outline

The machine drafting and design program was started in the fall of 1954. Southern Illinois Univer-

Students in machine drafting and design technology at V.T.I. work at 38" x 60" drafting tables and have industrial-type drafting equipment available for use.

sity has the quarter system, so the 72 weeks required to complete the program are divided into six terms, with a minimum of 96 quarter credit hours required for graduation. The curriculum is organized to provide students with the basic knowledge and abilities for employment in industry as draftsmen, machine and tool designers, planners, detailers, inspectors, checkers, technical aides, liaison, quality control, etc. The student learns the language of engineering; the composition, properties, and heat treatment of materials; mechanisms; applied mathematics; and the art and science of the design of those machines which are essential in manufacturing processes.

The first year's work is devoted mainly to training in technical drawing and understanding of machine elements, materials, and manufacturing processes. The first term in engineering graphics classes covers the essentials of the engineer's language dealing with sketching, instrumental drawing, geometric constructions, lettering, projections, sectional views and conventions, dimensioning for unit production, threads and fasteners in detail, working drawings (small assemblies) by ASA standards. During this first quarter the student also takes algebra fundamentals and English.

The second term covers axonometric and oblique drawing (including dimensioning), principles and practices of descriptive geometry as involved in single and successive auxiliary views, true dihedral angle determination, revolutions, intersections and developments, bent-part design (for the most economical cutting consistent with function and appearance), welding specifications, lettering practice and some lettering with a lettering device, and additional assignments of more advanced working drawings and dimensioning. Additional work in manufacturing processes, college algebra, and an introduction to physics is given during this quarter.

During the third term, the drafting and design student studies miscellaneous fasteners, bearings, and machine elements; precision dimensioning, especially for interchangeable manufacture; piping; gears; cam design; duplicating methods and materials; and advanced working drawings requiring some designing and redesigning, and reference to handbooks and catalogs. He also takes trigonometry, a second term of physics, and a course in sociology.

The second year's work is chiefly devoted to the design or redesign of simple to more complex machines or items of manufacture for domestic use. such as vises, grinders, drill presses, rotary tables, wood jointers, oscillating mortisers, capacity wood planers, and others. All machines are selected so that they can be produced in the machine-tool laboratory. Complete assembly drawings with parts lists, and individual detailed drawings are made for production processing.

Every effort is made to simulate industry, and the

Second-year students design machines such as the multiple borer and mortiser below. The machines are then actually used in the machine-tool laboratory.

student is able to see most of the designed machines completed in laboratories at the Institute. For instance, parts needing welding are handled by the welding-laboratory students. If cast iron is needed, the wood-technology students make the patterns in the laboratory and a local foundry does the casting. Heat-treatment work is done by metallurgy-laboratory students and machine-tool technology students do such foundry work as pouring of aluminum and bronze. In many instances, the machine-drafting student is able to see not only the completed machine or product but has a hand in its manufacture.

Theory classes during the second year include kinematics, statics and strength of materials, jig-and-fixture design, and production tooling for automatic equipment. The student also takes two classes of metallurgy, technical writing, and political economy. He may complete his total credit-hour requirement by choosing electives, on recommendation of his adviser, from such courses as business correspondence, record keeping, oxygen-acetylene and electric-arc welding, speech, precision measurement, management and labor-relations problems—all of which are taught on the Institute campus. Should he desire, and if he has time, he may, of course, take courses on the main campus of Southern Illinois University. The University provides free bus service between Carbondale and V.T.I.

The individual's background and needs are taken into consideration when his program is planned. If he can exhibit proficiency in any of the required courses, he may, with his adviser's approval, substitute electives.

The two drafting laboratories at the Institute contain 44 38″ x 60″ drafting tables and stools, 24 drafting machines, 10 parallel rules, a three-sectional cabinet of drawers for filing student drawings, a portable tracing table, a combination printing and dry-developing machine with a maximum printing speed of 12 feet per minute, an overhead projector, electric erasers, beam compasses, 2 large paper cutters, lettering sets with templates for letters from .080″ to .500″ in height, and many other tools necessary to a draftsman or designer. The school supplies a variety of templates for use by the students until such time as they purchase their own for their tool kits.

The library at the Institute is more than adequate. Here the student may consult handbooks, American Standards Association, Society of Automotive Engineers, and American Welding Society standards manuals, such periodicals as *Machinery, Machine Design,* and *Product Design,* and a variety of textbooks in the field. In addition, there is an excellent collection of catalogs on file in one of the drafting rooms for student use. These have been supplied by manufacturers and are classified and filed according to the *1956 Design Data Manual,* along with other informational material.

Well-Equipped Laboratories

The machine-tool laboratory, where the design student sees his ideas transferred from paper to reality, is well equipped. Included in the facilities are 13 engine lathes of various capacities, two shapers, two horizontal universal mills with index heads and one rotary table, two vertical mills equipped with standards, three surface grinders, two universal cylindrical grinders, one carbide grinder, three off-hand grinders, three tool-and-cutter grinders, four drill presses, three turret lathes with universal tooling, one automatic lathe, one borematic, one gear shaper, one 14″-screen optical comparator, two sets of gage blocks, two electro-limit gages, snap and ring gages of various types and sizes, a 42″ x 60″ surface plate,

Some of the parts designed in machine drafting and produced in the laboratory are shown below. Complete assembly drawings, parts lists, and details are required.

hand tools for bench work, and attachments and accessories for the various machine tools.

The welding laboratory has 16 stations for gas welding, and 19 for arc welding of which five are dual-purpose stations for inert arc and metallic arc as well as arc welding. In addition the laboratory has equipment for metal spraying and arc air cutting.

The metallurgy laboratory is well equipped. At present it contains Rockwell and Brinell hardness testers, polishing equipment and microscope (50-1900 diameters), forging and casting equipment, and gas and electric furnaces for hardening and tempering. In the past year a Universal testing machine (0-60,000 psi) has been installed and is used quite extensively.

Eight years ago, 16 students enrolled in the first quarter of this machine drafting and design program. Each year has seen a gradual increase of students until at present there are 63 studying full time. This increase would seem to indicate a demand for workers in this area of study and student satisfaction with the training received. The number of dropouts due to lack of ability, illness, military service, financial difficulties, and especially to employment prior to completion of the course, has been approximately 23 percent.

Reactions of former students to the program have been varied. Graduates have made such comments as, "I had just what my employer required"; "My vast amount of board experience helped me materially in my job"; "More study in metal science and machine tool would have helped me"; "More math would be desirable"; and "I didn't have enough training in physics." These statements indicate that to some the past and present curriculum offerings have been entirely satisfactory while to others a change in course content might have been desirable. Contacts with employers have indicated a range of satisfaction all the way from, "This is just a wonderful offering," to specific criticisms with respect to the need for more

All students in machine drafting and design technology take a course in elementary metallurgy so they will become acquainted with processes used in industry.

theoretical study and perhaps less laboratory practice.

In general, it should be said that the present curriculum is good and is well accepted. (Advancement on the job of graduates who have been in industry for two to three years and the return visits of industrial personnel for employment interviews with our present students indicate the value of the program.) Every effort is made to improve the program in terms of preparing the "engineering aide" type of technician while not losing sight of the more or less vocational requirements of those students who may be employed in jobs where they work on the board most of the time.

Counseling with Industry and Labor

From the inception of the program to the present time, representatives of several major industries have cooperated with the faculty and administration of the school in analyzing the needs of industry in terms of machine drafting and design. They have been free with both criticism and praise of what has been done and what is being done and have shown willingness to accept a responsibility in the total training program.

As industry plans change and employer requirements demand alterations in the curriculum, we can rely on the help of both labor and industry to inform us of such needs and to work with the school in the revision of the curriculum and later in the evaluation of the results. The willingness of labor, industry, and business to sit down around the table with the faculty and discuss freely and openly the direction in which the training program should develop has been both helpful and stimulating.

One of the most valid appraisals of any technical program will be found in the success of its graduates. Our experience to date shows that a very large percentage of the students completing the full two-year program find employment with which they are personally very satisfied in terms of both income and opportunity for advancement.

The Southern Illinois placement service keeps a file on each student for the purpose of placement and follow-up. Employer representatives come to the V.T.I. campus and the main campus of S.I.U. to interview students at regular intervals during the year, and the placement service works with the state and federal employment agencies. Consequently, student employment opportunities have been excellent.

Training Drafting Technicians At V. T. I., Southern Illinois University

B. Architectural Drafting and Design Technology

By Paul J. Lougeay

Coordinator, Construction Technology Department,
Vocational Technical Institute,
Southern Illinois University, Carbondale

"WE ARE interested in interviewing a group of your next graduating class of architectural-drafting and architectural-design students . . ." This beginning is typical of the many letters from architects and building-industry leaders that cross my desk as coordinator of the architectural technology program at the Vocational Technical Institute of Southern Illinois University. These letters represent responsible positions, and their salaries more than favorably compare with those of other programs offered at Southern Illinois University.

Many architectural firms must forego the luxury of hiring a graduate of a five-year architecture program and then face the possibility of losing the employe at the point when he contributes to company profit. This loss, resulting from the graduate architect becoming registered and possibly starting his own practice, can be financially difficult for the average office to shoulder. The achievement of state registration is not confined to the five-year graduate, however, inasmuch as graduates of the technical institute can also attain this status.

It then becomes the position of the technical school to supply the profession with the trainee who can perform efficiently in the position between the licensed architect and engineer, and the office draftsman with a high-school diploma as educational background. It is true that men with high-school backgrounds can be trained as draftsmen, but the time involved is sometimes almost prohibitive.

The role that the two-year technical curriculum plays in this area of training beyond the high school is increasingly important. Recognizing this importance, Southern Illinois University established the Vocational Technical Institute and authorized the granting of Associate Degrees in Technology. One of the first study areas to be considered was a two-year, terminal program in architectural technology. The program, as it now appears in the official University Bulletin, requires 101 quarter hours for graduation. Of these 101 quarter hours, 80 are in technical and technically related fields. It should be noted that the requirements for admission to the architectural technology program are the same as the requirements for admission to the University and can be found in the *General Information Bulletin* obtained from the registrar of Southern Illinois University.

Realizing the value of academic background as well as technical training, the program at the Vocational Technical Institute includes 21 hours of credit in general academic subjects. These 21 hours cover study

Structural-design students are taught to understand the relationship of framework and esthetics by instruction in mechanics and strength of materials.

in the fields of government; psychology of human relations; English composition; physics; college algebra; and trigonometry. These academic subjects are selected from the University's general-studies program. Students in all the disciplines offered at Southern are required to take certain selected courses in this general-studies field.

The technical aspect of the curriculum includes intensive training in the architectural profession in fields of design, materials and methods of construction, mechanics and strength of materials, structural engineering, site engineering, mechanical equipment of buildings, office practice, basic materials, architectural history, and cost estimating.

Three Major Divisions

The main core of the curriculum is built around the three major aspects of the architectural profession: architectural design, materials and methods of construction, and structural engineering.

The first of these, architectural design, is concerned with the esthetics of architecture as it relates to function, planning, circulation, and development of the building. Although many of the students achieve a high refinement in architectural design, the courses are also designed to help develop an understanding of, and an empathy for, the problems of the designing architect, so that the student's interpretation of the design solution is more easily transferred to the working drawings.

The second major division in the curriculum concerns materials and methods of construction. These courses are built around the production of working drawings. Emphasis is placed on complete sets of working drawings and specifications in frame construction, semifireproof construction, fireproof construction, and variations and combinations of the above. The difficulty in this type of instruction, of course, lies in the fact that no two architects or builders use the same standards and methods in working drawing production. The student is given to understand that variations in standards do exist from architect to architect and that adjustment to these variations is imperative for success.

Structural design, the third major area of study, embraces strength of materials, timber design, steel design, and reinforced concrete design. The direction in this portion of the program is toward the standard, basic formulas and their application in the use of handbooks common to each material considered. Besides a thorough understanding of structural design, the student again develops an awareness of the problems of the structural engineer, thus making the student's interpretation more complete.

To augment these three major areas of investigation there are those studies which are directly related to

A basic understanding of the parts leads to an understanding of the whole. Here a student in materials and methods of construction studies the shape of an extruded window section for detailing.

architecture, but basic in nature. Included in this portion of the curriculum are such important courses as fundamental drawing and freehand architectural graphics. These courses are designed to provide the beginning student with the basic skills and methods of drawing, including orthographic projection, perspective, shades and shadows, reflections, and isometric and oblique drawing. As in all university programs, these basic courses need to be geared to the various high-school backgrounds of the student. The speed at which the instructor can present the material in the early stages of the student's training will vary with the individual backgrounds and abilities in the class. Talented students, or those with considerable previous training, soon discover that the pace and pressure of the two-year, accelerated program puts great demand on their skills. The competition for grades and academic recognition is arduous.

Other Related Courses

Other major related courses considered in the architectural technology program are site engineering and mechanical equipment of buildings. Both of these, because of the time element involved in a two-year program, must be of a survey nature. The site engineering course of study includes the use of the level and the transit and the mathematical interpretation of the problems involved.

Freehand architectural graphics develops skill in perspective, shading, and color, as well as an understanding of the theory of color.

One of the more important courses that is offered is designed to assist the student in making the transition from academic training to actual employment in the field. The study of job orientation brings to a climax the entire two years of study in the professional and academic areas and helps the student focus on the relationship of all his previous studies. Closely allied to this course is one encompassing architectural practice and the ethics of the profession. It gives the student a better understanding of the practice of architecture and the activities of the building industry.

Teaching Staff

The teaching staff in the architectural technology program is drawn from the architectural profession itself. For the most part, all instructors in the department are registered architects with many years of experience in the field. The academic background of each is represented by four or five years of formal schooling and the required period of apprenticeship set down by the State Architectural Examining Board. In the interest of staying abreast of the rapid changes in architecture and its related fields, members of the staff are encouraged by the University administration to pursue limited practice in addition to their teaching duties. This policy provides for flexibility within the individual, as well as a flexible program. It brings about a refinement of material and philosophy of teaching which is reflected in our rapidly changing technological age. Because of the academic and professional background of each instructor, it is possible for him to teach at a pace which prepares the student for the atmosphere that prevails in the architect's office.

The Technical Institute, in reinforcing the program, has made available excellent facilities and equipment for instruction. Drafting-room laboratories and classroom space, totaling 5,100 square feet, are equipped in such a way that they have the environment of the office drafting room; however, the many teaching aids such as overhead projectors, slide projectors, and reference books are used by the teaching staff and students.

Library Facilities

The students have immediately available a technical library of some 3,000 volumes and a periodical library of 125 titles, including five magazines of foreign origin pertaining to the architectural field. The technical library also includes a 15-drawer file of technical pamphlets and similar publications. The student also has available to him the use of the 600,000 volume main University library which has 3,500 titles in the periodical field. These excellent library facilities make possible research and extensive outside reading.

The architectural technology department boasts of an excellent color slide collection of some 1,500 slides representing historical-period architecture as well as contemporary works. In this collection is represented virtually every style of architecture since the early Egyptian pyramids.

The information given above, including three major or accent areas of study, the related courses of study, the teaching staff, and the library facilities, make possible a unique teaching method. All of the courses of study are coordinated both horizontally and vertically. When students are studying reinforced concrete structural design, they are also investigating the esthetics of reinforced concrete design and the problems of reinforced concrete detailing and specifications. This coordination then presents the entire picture of the use of reinforced concrete to the student.

To better understand and relate the theoretical and laboratory experience to the actual problems of construction, numerous field trips to nearby metropolitan areas are made. The Institute is located geographically within a reasonable driving distance of three metropolitan areas so that selection of visits to correspond with the course of study is possible.

Placement

Although placement of the students in jobs presents no major problem, Southern Illinois University provides a placement service for all graduating students. It is interesting to note that although the architectural technology program is directed primarily toward placement of students in architects' offices, many of them find their way into lucrative fields related directly to the architectural profession. Students have been successful in positions involving selling of construction materials, building inspection, operational supervision, and product design. Many graduates have found well paying positions with firms which are engaged in fabrication of building materials and equipment. In these firms they function in the capacity of designers, assistants to engineers, and in the production of shop drawings. Graduates have assumed positions of leadership in the architectural drafting and design fields. Their employers have found that they were equipped with information and technical skills which reflected the academic excellence and quality of workmanship cultivated in our two-year program.

Training Building-Construction Technicians at Southern Technical Institute

By Robert Hays

Associate Professor, Southern Technical Institute
Marietta, Georgia

TO paraphrase one of the poet's works, "the best-laid plans of architects often go haywire," is to realize one of the realities of the building industry. There are many opportunities for "slips" between the architect's ideas and a home or building ready for occupancy. Since slips are expensive, somebody must minimize the errors—somebody must make certain the home owner or building owner gets his money's worth of safe, long-lasting structure.

In Marietta, Ga., Southern Technical Institute is training the "somebodies" who will turn architects' plans into buildings. Southern Tech, a pioneer technical institute for the South, is an important source of building-construction technicians.

In the South, one of the biggest industries is building construction. In one year during the Korean War, southeastern industrial firms invested more than two-thirds of a billion dollars in new plants and equipment. Total construction in the region amounted to nearly $7 billion that year. Nearly 60,000 people now work in contract construction in Georgia alone. New subdivisions, new shopping centers, and new industrial plants are rising where ten years ago only loblolly pines grew.

New construction has created a shortage of trained personnel, especially in the intermediate-management jobs. The South has too few strawbosses, not enough building materials salesmen, and an inadequate supply of estimators. Fifteen years ago, Georgia's Board of Regents decided to alleviate the shortage of these middle-management people in building construction and in other major industrial fields. Southern Tech, originally established in Chamblee and since moved to a new campus in Marietta, was the answer.

Southern Tech products are trained engineering technicians. Their academic programs combine both theoretical and practical education. At the beginning of their programs at Southern Tech, future engineering technicians take basic college courses in mathematics (through analytical geometry), drawing, physics (three courses), and English (four courses, including public speaking and technical writing). In addition, all students take a course in human relations—the applied industrial psychology of getting along with people and supervising them on their jobs.

These are the kinds of college courses that help to make engineering technicians educated men and women, people capable of advancing to more responsible work. The engineering technicians also need many courses in the general technical field. All building-construction students study blueprint reading, surveying, graphics, mechanics of materials, and two courses in structural drafting. But the heart of the building-construction program is a set of specialized courses in building practices. These courses include building materials, wood and steel construction, building equipment, concrete construction, and costs and estimates. All building-construction students take three quarters of building design.

These courses produce students who can earn their pay very soon after they start to work. One of the complaints employers make most frequently is that new employes cost too much to train. Many graduates of conventional colleges report for work with a broad general background but without enough specialized training to enable them to earn the salaries they expect to be paid. Frequently as much as a year may elapse between an employe's first working day and the time the employe is really earning his salary. But the graduates of building construction at Southern Tech have experienced in college every phase of construction—from writing building specifications through each step in erecting the final structure.

Learning building-construction practices also means taking a course in surveying, since placement of corners and batter-boards is very important.

Solving Problems

The building-design courses focus the students' learning on solving problems. In the first building-design course, students prepare "specs" for dwelling houses. They also prepare presentation drawings and (with advice from instructors) complete working drawings. Finally, working in groups of three to five students, they build cutaway scale models of dwellings. Construction of the models—executed in miniature scale—involves every step met in constructing a full-sized dwelling.

Building-construction students thus learn the present and future of the construction industry. But they should also know something of the past as well. A technical institute generally offers such a crowded program that students have little time for history or general culture. But all building-construction students at Southern Tech take a course in architectural history. They learn the fundamentals of building methods from the Parthenon to Frank Lloyd Wright.

All courses fit into a subject-packed curriculum of

Model building is an important phase of education for the future engineering technician in building construction. Left: Under an instructor's watchful eye, building-construction students at Southern Tech build a scale model of a house they have designed. Right: The scale models must show construction cutaway details.

two college years. Students who take the standard schedule carry an average of 19 credit hours per quarter for six quarters. In effect, Southern Tech building-construction students take about two-thirds as many hours as students in a conventional college, but Southern Tech students finish their programs in half of the time required for students in a typical four-year college.

Students must stay busy to pass the difficult courses and carry the demanding schedule. Part of their success in passing the work may be attributed to high entrance requirements. All students must have high-school diplomas or the General Educational Development test (USAFI) equivalent. They must have three years of high-school math (including one in geometry), two years of science, and four years of high-school English, or they must take remedial work. In addition, they must have College Entrance Board scores and scores on Southern Tech's own entrance tests to help in assigning them remedial courses.

The rewards for meeting the entrance requirements and studying hard in school come immediately after graduation. Southern Tech maintains close liaison with industrial firms and contractors—an average of over 300 industrial firms send representatives to interview students each year. Most of the students will have accepted positions weeks before they graduate.

Records of Graduates

Starting salaries tell part of the story of the graduates' reception in industry. Currently the average starting salary is slightly over $410 per month. The first graduates in building construction, finishing in 1949, started at an average salary of only $205 per month. Thus, as Southern Tech has become better known and as industrial firms have bought its products, starting salaries have risen by approximately 100 percent.

On their jobs, building-construction graduates have received promotions in both titles and salaries. Many who were lucky to get jobs as drawing tracers in 1949 have since risen to much more responsible positions as estimators, superintendents, and self-employed contractors. The average salary of the 1949 graduates in building construction had risen from the aforementioned $205 per month to an average of $850 per month in 1961. Thus, graduates have more than quadrupled their salaries in less than a decade. Promotional records made by the graduates of Southern Tech's ten other technical programs are just as commendable.

Some Southern Tech students have money troubles—a common phenomenon on college campuses everywhere. Students can take several routes to make their bank accounts stretch. A "co-op" program is one of the most popular routes. Under co-op plans, students alternate working on jobs in their fields of interest and attending classes. Co-op plans help financially. More important, though, they give students extra experience. Co-op plans do require longer—33 months to finish instead of 18 months.

Some students take only a few courses at a time and work to support themselves. One large industrial firm near Southern Tech pays half of the tuition costs for salaried employes to take Southern Tech's industrial courses. Like the co-op plan, this scheme of going to college part time takes longer to complete the program—sometimes twice as long.

Night School

Students who must support themselves, but who cannot find night jobs, find it difficult to take courses in day school. Their best route is to work during the day and go to school at night. Southern Tech operates as a unit of Georgia Tech's Engineering Extension Division. The Extension Division also offers building-construction courses at night on the Georgia Tech main campus in nearby Atlanta. Thus, students who want degrees in building construction from Southern Tech can pursue their studies in day school or night school.

The night-school plan, like the co-op plan, takes longer, for night-school students usually carry only half of a load of school work. Southern Tech's day-school enrolment is currently running between 900 and 1,000 students. Approximately 200 students are enrolled in night school. Building-construction students account for about 10 percent of the day-school enrolment and a slightly higher percentage of night-school enrolment.

Growth in enrolment has followed public acceptance of the Southern Tech program. When the first students registered in March, 1948, Southern Tech suffered several disadvantages. First, it was the South's first technical institute, and probably not one Southerner in 10,000 even knew the definition of a technical institute. Second, the planned curriculum had no academic bill of good health—no accreditation. Third, the school had no permanent campus. (In the urgency to start a school, the University System had to rent part of a U.S. Naval Air station in Chamblee and convert barracks to classrooms.)

Obstacles Overcome

When the Southern Tech faculty celebrated the fifteenth birthday of the school in March, 1963, the faculty had overcome these major obstacles. An aggressive public-relations program had acquainted high-school counselors, principals, and students with the technical institute *as an idea.* Industrial representatives had helped publicize the program through their plant newspapers. High-school counselors had toured the school's classes and laboratories. Almost every year at least one shop teacher brought an entire class to tour Southern Tech shops. Faculty members had represented the school at career days and college days.

The Engineers' Council for Professional Development has accredited all of Southern Tech's programs which were eligible for accreditation, including building-construction. Early in its history, Southern Tech received approval from the Veterans Administration as a program under all GI bills. The War Manpower Commission also has endorsed Southern Tech.

The third obstacle has also tumbled. Southern Tech moved in October, 1961, to its permanent campus in Marietta. Nearly 200,000 square feet of space is available for lab, classroom, and administrative areas.

Southern Tech will probably add new programs as industrial needs arise. The original seven programs have grown to 12 at present: building construction, civil (surveying and construction), civil (structural materials and design), electronics, power, gas fuel, heating and air conditioning, industrial, industrial management, mechanical, telephony, and textile. In the next few years Southern Tech will probably begin programs in chemistry technology and in some branch of nucleonics.

New programs develop strictly on the basis of industrial need. The entire success of a technical institute depends on meeting industrial need; a program must have customers—industrial employment managers—ready to buy its products: the graduates.

In the case of building-construction technology, the future seems assured. The department head expects to be in the technical-institute phase of education for years to come. Building, which provides one of life's three necessities, will certainly provide a long-term market for graduates.

Training Mechanical Technicians at Milwaukee Institute of Technology

By George Parkinson

**Director, Milwaukee Vocational and Adult Schools,
Milwaukee, Wisconsin**

THE success of any technical institute curriculum is fundamentally governed by two related, though nonetheless distinct, criterions; its content and the level at which it is taught. Mechanical technology, encompassing a vast bewildering area of diverse technical endeavor, requires a broad and inclusive curriculum. The inclusiveness is, however, severely restricted by the length of the program. Certainly not all, perhaps not even most, of the topics and subjects that would be of value can be injected into a two-year program. Without the luxury of time, the merely worthwhile must yield to the truly significant and essential. Similarly, the level or depth of coverage accorded any topic included in the curriculum is confined to a narrow, rather elusive area between mechanical engineering on the one hand and the mechanical trades on the other.

Though the content and the level of the mechanical-technology program presented here is, and should be, related to engineering and vocational and trade training, it does possess a unique individuality having its own objectives and its own specialized curriculum. The ever-present danger in organizing such a curriculum is that its kinship to these more familiar areas of technical endeavor may tend to obscure its identity so that it erroneously assumes the character of a diluted engineering curriculum or an enriched trade course.

To negotiate the narrow path leading to the successful curriculum requires, first, an alert faculty—not only specialists in strength of materials, metallurgy, tool design, graphic presentation, machine tools, mathematics, time and motion study, communication skills, industrial planning, but also specialists with a desire and an ability to teach. The second ingredient is the advice of persons in the industrial community associated with mechanical technology and interested in technical education. Next, mix the two, faculty and invited community resource people, in well-planned meetings having pre-announced, limited objectives (generalized discussions are seldom productive), and a dynamic balanced curriculum will eventually emerge. The desired atmosphere at these meetings is attained when each topic and the level at which it is taught is challenged by some members of the group and defended by others—when each topic taught is under constant scrutiny, vying with other topics seeking to displace it.

The mechanical-technology curriculum at the Milwaukee Institute of Technology is the direct result of innumerable industrial advisory committee meetings dating back to 1924, when a request from Milwaukee industry caused the establishment of an evening technical program. In 1951 the Milwaukee Board of Vocational and Adult Education formally authorized an Institute of Technology as one of several schools it supports and maintains, with mechanical technology being a prominent aspect of the institute's offerings. The content and order of the curriculum is intended to provide a high-school graduate of average to somewhat above average ability with the broad fundamental knowledge and specific industrial skills required of a mechanical technician. Further, it must provide the foundation for a variety of potential industrial occupations and still be complete within itself, i.e., terminal in nature. It must include material relating to all aspects of mechanical technology, emphasizing those areas peculiar to the local scene. The scant two years allotted to this task dictates a rigid curriculum, devoid of electives, with each subject making its full contribution toward the objectives of the program.

Reference to the listing of subjects in the curriculum will show a two-year program with a choice of majors in the second year. A deliberate effort was made to keep the number of majors at a minimum, thus avoiding unnecessary fragmentation of the program. The subject order was arranged to provide a common first year for both majors to allow an undecided student additional time to make a wise choice of his specialty.

An instructor at Milwaukee Institute of Technology demonstrates the construction and use of isometric drawings in a course in technical drafting.

CURRICULUM SUBJECTS

	Credits	
First Year	*1st Sem.*	*2nd Sem.*
*Technical Drafting 1	3	
*Manufacturing Processes 1	3	
Communication Skills 1	3	
Technical Mathematics 1	4	
Physical Education	1	
Psychology of Human Relations	3	
Orientation	0	
*Technical Drafting 2		3
*Manufacturing Processes 2		3
Communication Skills 2		3
Technical Mathematics 2		4
*Technical Science 1		4
	17	17

DESIGN MAJOR

Second Year		
*Technical Drafting 3	3	
*Descriptive Geometry	3	
*Mechanics of Materials	3	
*Basic Hydraulics	2	
*Technical Science 2	2	
American Institutions	3	
*Basic Tool Design		4
Design of Machine Elements		3
*Basic Mechanism		3
*Design Problems		4
Business and Industrial Relations		3
	16	17

MANUFACTURING MAJOR

Second Year		
*Motion and Time Study 1	3	
*Process Planning and Methods	4	
*Production Control	3	
Basic Statistics	3	
American Institutions	3	
Materials Handling and Plant Layout		2
*Motion and Time Study 2		3
Quality Control		3
Manufacturing Costs		3
Personnel Administration		3
Business and Industrial Relations		3
	16	17

*Associated with a laboratory

Technical vs. General

Before specific aspects of the curriculum can be explored, a fundamental decision allocating the available time between technical and general education subjects is imperative. The pressure of time and the vast amount of technical material available for presentation must not be allowed to dictate a curriculum deficient in the equally vital, though less spectacular, nontechnical subjects.

A typical on-the-job assignment for a mechanical technician involves: (1) the comprehension of the task, (2) the performance of the work, and (3) the communication of the results. Aside from the obvious fact that the technician must know how to live and work successfully with others in a complex industrial society, items 1 and 2 clearly demand superior ability in the written and spoken word. To think, analyze, and reason his way through a problem, a technician relies on a reservoir of knowledge in mathematics and the basic sciences, but he can neither manipulate nor articulate his thoughts without fluency in the mother tongue. Words are the tools of the mind. To deny the need for general-education subjects in the curriculum is to relegate the technician to the status of a craftsman fashioning substance rather than ideas. To justify themselves, however, the general-education subjects must contribute in a real and specific manner to the objectives of the mechanical-technology curriculum.

Subject Integration

Unfortunately, many of the vital factors that have contributed to whatever success this mechanical-technology curriculum enjoys cannot be gleaned from a listing of the subjects taught or even from an examination of the outlines of instruction for the various courses. Complete integration of all subjects in the curriculum is one such factor. In an integrated curriculum, no subject is taught as an isolated or compartmented unit of knowledge, but each is planned *to reinforce* the efforts of the others. As each course introduces a principle or technique, other courses pick up the thought, build on it, elaborate on it, modify or apply it. Thus, technical mathematics is not algebra or geometry, but a vital necessity to obtain an answer to a practical problem in motion and time study; and communication skills is not English or speech, but the answer to the technique required to prepare a written or spoken report in process planning and methods.

Through each course in each semester, a deliberate effort forces the student to use and re-use the knowledge presented earlier, culminating finally in the fourth-semester design and layout courses which draw on material from every course in the curriculum. A subject-integrated curriculum makes use of the teaching dictum—repetition, repetition, repetition—on a truly grand scale. It may be appreciated that a successfully integrated curriculum is a highly efficient one, allowing more knowledge to be imparted and more learning to take place in a given length of time. Integration becomes a dynamic reality only in a school situation where dedicated instructors are united in a common purpose; it dies for want of articulation between instructional departments.

Theoretical and Practical

Another hidden though exceedingly important aspect of this curriculum is the delicate balance struck between the theoretical and practical material presented. The theoretical is needed not only to understand the current state of mechanical technology but also to interpret future developments bound to occur after graduation. On the other hand, an employer requires a graduate to possess the ability to manipulate the tools and instruments which are common to mechanical technology. Laboratory time and equipment is thus determined by the purpose of the experiment, the confirmation of a principle, the familiarization with an industrial application, or the acquisition of a technique. In the latter instances, the equipment must be representative of present industrial practice—modern, accurate, expensive. T-squares must give way to drafting machines, micrometers to gages, industrial-arts type of lathes to industrial machine tools.

As can be seen from the list of subjects, most technical courses are associated with laboratory work. The time scheduled in a laboratory and the credit value assigned is related to the total amount of effort involved and the portion of the required work a student completes in school as compared to that which can be done at home. On this basis, one credit may be given for a two-, three-, or four-hour laboratory session. Comprehensive laboratory reports are invariably required, for only in the solitude of writing is there the opportunity to reflect, deliberate, and assimilate the action of the experiment. Pervading all laboratories is the essence of the scientific method, the analytic approach to the solution of a problem. It is expected that an hour of study time will be required for each hour spent in most laboratories and that two study hours are needed to do justice to each hour of lecture.

In a two-year curriculum, as many technical areas as possible must be broached in the first semester to permit a rapid expansion of knowledge in all directions before the program runs its course. Technical Drafting 1, for example, opens the door to an understanding of the most commonly used tools in mechanical technology—the drawing, sketch, or blueprint. Manufacturing Processes 1, dealing with the cold processing of materials, introduces the student to accurate dimensional measurement and the operations that can be performed on the various machine tools. Technical Mathematics 1 also serves to open an area that will be used by all other technical courses. It satisfies the students' immediate demand for removing the routine labor in calculation by introducing the slide rule.

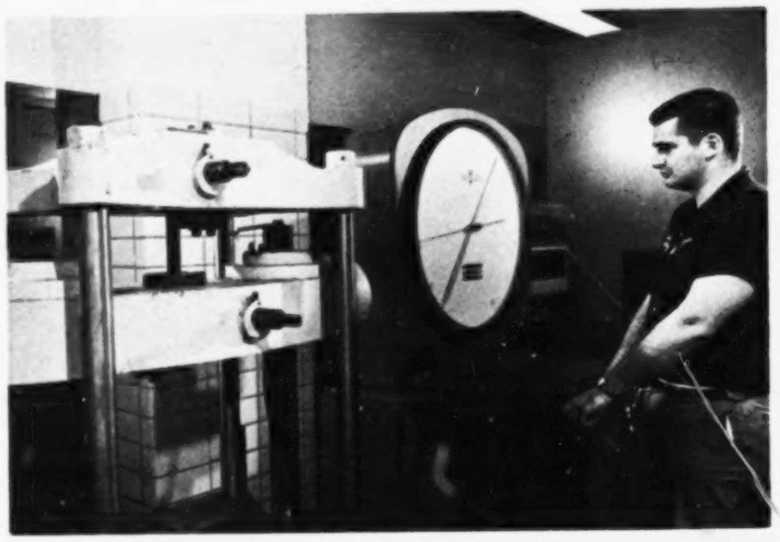
The no-credit course in orientation has proven to be of inestimable value in acquainting the new student with the school; with the world of work and the role of the mechanical technician in industry; and with himself, his aptitudes, and interests. It is predicated on the assumption that a student brought face-to-face with the stark realities of his chosen niche in industry may be spared a lifetime of frustration. The instructor assigned to the orientation classes is a mechanical-technology specialist who is also the students' faculty adviser.

Entrance Requirements

Prior to admission, all students are tested for ability and aptitude. During the individual interviews that follow, counselors encourage the superior applicants to seek college work elsewhere while recommending vocational programs for others. Subsequent to admission, the orientation course assumes the burden of the guidance function.

High-school graduation with a year of algebra and geometry are entrance requirements. One year of natural science, two years of social studies and history, and three years of English in high school provide a highly recommended background. Regularly scheduled noncredit courses to ratify high-school deficiencies find wide acceptance.

Eligibility for admission may also be obtained by applicants over 21 years old through an evaluation of their work experience, education, and an entrance examination. Rigid adherence to an admission policy based solely on high-school performance may penalize a serious adult for the failures of his capricious youth. Experience has shown that high-school rank is all too frequently more indicative of teen-age maturity than native ability. Liberalized entrance requirements do not imply a lowering of standards



A mechanical-technology student performs a tension experiment in the metallurgy laboratory.

A student in the design of machine elements course at Milwaukee Institute of Technology is shown here working on a worm gear transmission design.

As part of their work in the time and motion study course, students perform a time-study experiment on a drill-press operation.

but, rather, account for the large number (perhaps 50 percent in the course of the two-year program) of dropouts and failures. When viewed in the light of the proven number of successful graduates who would have been barred from admission by a rigid policy, the cost of the dropout problem is not excessive. Ultimately the standards of an institution reside in the hands of the instructors, regardless of admission requirements.

Follow-Up Program

An active placement and follow-up program reveals that over 95 percent of the June, 1962, mechanical-technology students responding to a survey are either working in the field for which they trained or have gone on to further schooling. The average monthly starting salary for the graduates was $355. It is the school's policy to survey former students in September following their June graduation, two years after graduation, and five years after graduation. The survey inquiry to the June, 1962, graduates brought an 86 percent response.

The surveys also provide information concerning the strong and weak aspects of the curriculum as viewed by each respondent from his particular vantage point. This is the kind of feedback that breeds constructive changes in the content of the curriculum.

From the experiences of the placement department, it can be stated that there is not a shortage of mechanical technicians. There is a shortage of *good* mechanical technicians. Top quality students have received three and four concrete job offers before graduation, while marginal graduates must be content to wait for a reasonable offer. Graduates have obtained employment primarily within the immediate vicinity of the city. They have such job classifications as: laboratory technician, draftsman, junior engineer, industrial engineer, field service representative, standards engineer, production control assistant, and junior designer.

In this brief report, no attempt was made to outline the content of any course. This would have been a particularly easy but unrewarding task since a topical list of the material covered in each course could in no way indicate the subtleties of emphasis, level of instruction, and the interplay between courses which are the all-important aspects of the curriculum. Furthermore, reference to the table of contents of any technical level textbook with a title remotely resembling the titles of the courses listed here will provide the reader with a far more exhaustive topical outline than could possibly be displayed in this space.

As a practical matter, courses are taught from textbooks. The importance of the choice of a text with the desired content and written at the appropriate level cannot be ignored. Each school working with community advisory committees can then modify the text material through changes of emphasis, deletions, and supplementations to satisfy the requirements of the course as it sees them.

The construction of a curriculum in mechanical technology is to some extent an individual community matter tailored to the immediate needs of the community. But it should have an educational soundness that will serve its graduates in the future and in any community. The battle is won when an awareness of the role of the technician in industry permeates the school and the community.

Training Metallurgical Technicians at Henry Ford Community College

By Lester A. Twork

Coordinator, Technical Education,
Henry Ford Community College,
Dearborn, Michigan

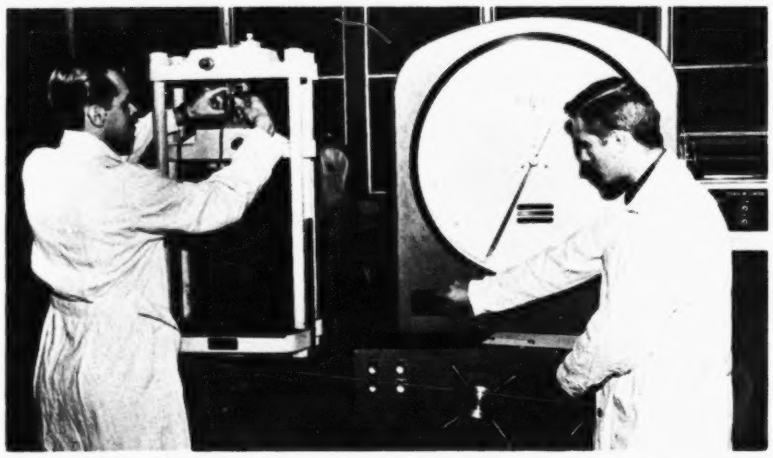
WITH the many technological developments in the metallurgical field and increasing uses of the exotic metals and materials in space vehicles, the metallurgy program at the Henry Ford Community College has become one of the most needed areas of study. Job opportunities for the metallurgical technician have been increasing steadily since the technical programs were started in 1955. Because of the high concentration of industries in the Dearborn-Detroit area, most of the job placements are made within a 10- to 20-mile radius. However, there have been requests for technicians from out-of-state.

As an indication of the success of the metallurgical program, a recent survey of the graduates shows that all are employed. Opinions and reactions concerning their performance have been most satisfactory. The fact that there are more available jobs than graduates offers a challenge to the technical division of the College.

Between 1948 and 1962, the total enrolment at Henry Ford Community College rose from 600 to about 7,000 students—an increase of over 1000 percent. It is one of the largest community colleges in the United States and offers technical programs in automotive, drafting, electronics, and metallurgical technology, as well as preprofessional programs.

In February, 1962, all divisions of the Henry Ford Community College, except the Technical and Related Apprenticeship Training, moved into four new buildings on the Fairlane Campus, the estate of the late Mr. and Mrs. Henry Ford. This beautiful, 75-acre campus location is adjacent to the Dearborn Campus University of Michigan, a 210-acre partially wooded site. Construction of the Technical Building on the new campus will soon be started and, when completed, will help to solve the problems of split campus operation. At the present time, technical students must go to the new campus for English, social studies, and mathematics classes.

Curriculum development for the metallurgical program followed the usual plan of using survey data and suggestions from an industrial advisory committee. Inasmuch as the college is located in the center of the automotive industry, it was not too surprising that a 94.6 percent response to the survey questionnaire was received. During the past six years some changes in curriculum have necessarily come about because it was found that cooperative work experience can better be scheduled on a semester basis than on a half-semester plan. Operating on two five-week sessions during the summer with the cooperative student alternating between school and the job did not prove



Two students adjust an electronic extensometer on a tensile specimen in the mechanical testing lab.

successful. The academic portion of the present metallurgical curriculum consists of two school years, or four semesters.

Metallurgical Curriculum

The program is directed toward the study of the principles of metal science and practice in the laboratory skills which are covered in seven metallurgical courses. These major areas are included in the study of grain structure of metals, chemical analysis of the elements in steel, measurement of the mechanical properties of metals, and laboratory practice in shaping and joining of metals by several processing techniques. Approximately 50 percent of class time is devoted to laboratory experiments in the following two-year curriculum:

First Semester	*Credit Hours*
Industrial Materials 10 (engineering materials)	3
Mathematics 10 (algebra, geometry, slide rule) or Math. 25, or 41, if qualified	4
Chemistry 10 (general chemistry) or Chemistry 31, if qualified	4
Machine Tools 11 (machine-tool processes)	3
Physical Education 31	1
	15

Second Semester	
English 10 (composition) or English 31, if qualified	3
Physics 10 or 31 (mechanics, heat)	4
Mathematics 11 (geometry, trigonometry, slide rule) or Math. 28 or 19, 42, if qualified	4
Metal Processing 11 (heat treat, welding, testing)	3
Metallurgy 12 (basic metallurgy)	2
Physical Education 32	1
	17

Third Semester	
English 11 (composition and reading) or English 32, if qualified	3
Physics 11 or 32 (magnetism, electricity)	4
Social Science 10 or Economics 60	3
Metallurgy 13 (general metallography)	3
Metallurgy 14 (mechanical tests on metals)	2
Auto 17 (related information)	2
	17

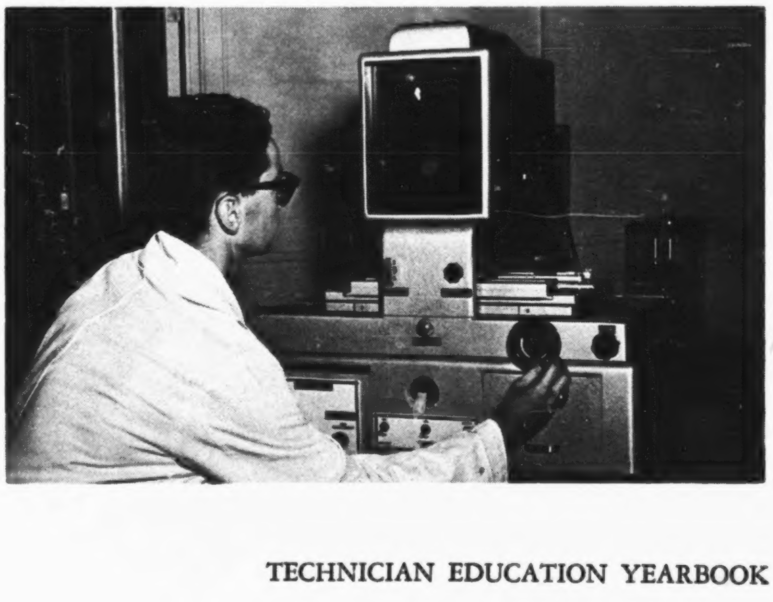
Fourth Semester	
Social Science 11 or Political Science 31	3
Metallurgy 15 (advanced metallography)	3
Metallurgy 16 (quantitative analysis of steel)	2
Drafting 10 (basic drafting)	3
Hydraulics 10 (basic hydraulics)	2
Elective, or cooperative work experience	3
	16

Satisfactory grades in courses numbered 31 or higher will give college transfer credit, although the main objective of the curriculum is job placement. Credit hours in cooperative work experience may be substituted for auto 17, hydraulics 10, and the elective if the student is placed in the plant for on-the-job training; two credit hours are allowed for each semester of work experience up to a total of six credit hours. The curriculum now requires 64 or 65 credit hours of study (depending on the amount of cooperative work experience), 14 in general education, 32 in related subject matter, and 18 in metallurgy.

Laboratory and Shop Facilities

The present metallurgical facilities in the Technical Building include a chemical and metallography laboratory, a mechanical testing laboratory, a metal

In the spectographic laboratory at Henry Ford Community College, a student uses a densitometer to scan line elements in spectrographic analysis.



processing laboratory, and three annexes (metallograph-microscope, dark room, and storage room). This represents a total of 4,800 square feet in which is included two lecture areas, each with a seating capacity for 36 students.

The first of the seven courses in the metallurgical curriculum is industrial materials. It includes the following topics: sources of common metals and methods of extracting them from their ores; various alloy types as revealed by alloy diagrams; and trade names, classification systems, and uses of the frequently used commercial ferrous and nonferrous alloys. In addition, the types of failures, such as fatigue, corrosion, and impact, are studied to acquaint the student with problems encountered in practice. A limited coverage of cement, concrete, and plastics is also included.

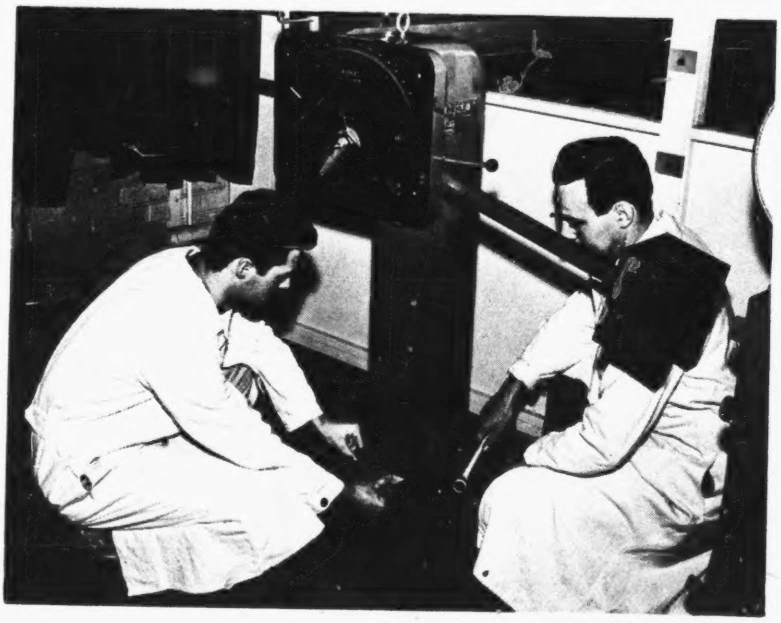
In the second semester, metal processing and basic metallurgy are offered. Metal processing is a combination of a laboratory and lecture course dealing with heat treatment of steels and some aluminum alloys, gas and arc welding of steels, some types of mechanical tests, and operation and adjustment of some temperature measuring devices. A number of the experiments in the aforementioned topics require graphs and data tabulation to be included in the laboratory report. Identification tests on metals, such as spark testing, sulfur print, observation of the fractured-surface, are correlated with other processing techniques.

Heat treatment is stressed in this course. Experiments include the effect of different quenching media on surface hardness, the effect of temperature and time in tempering, the effect of section size on hardenability of three types of alloy steel by Jominy end-quench; also practice in carburizing and checking of case depths by polish-etch and heat-tint method, and the solution heat treatment and precipitation hardening of 2017 aluminum alloy.

In temperature measurement of metal during processing, students use several kinds of pyrometric instruments—portable pyrometers, indicating and recording potentiometers, and optical pyrometers. Processed materials requiring specification checks give students practice in hardness testing, file tests, Brinell microscope readings on case depths, measurement of tensile properties, and setting instruments for certain scheduled time cycles of heating processes.

In gas and arc welding, emphasis is on the safe operation of equipment, the effects of different kinds of gas flame on carbon steels, the making of several types of gas-welded joints, and the proper settings on arc welders for a-c and d-c welding. Arc-welded sections are also checked for depth of weld penetration by macroetching. An inert-gas arc welder was purchased and used this past school year for the purpose of demonstrating the application of this specialized method to stainless steels and aluminum alloys. Although the average student may not attain a high degree of proficiency in the limited time he spends on welding, he gains some understanding of the techniques and limitations of the process.

Some of the major pieces of equipment in the



Two metallurgical-technician students adjust an impact-testing machine in the mechanical testing lab.

A time exposure is made to record the image of micro-grain structure in the metalloscope room.

metal processing laboratory are five arc welders (two ac-dc, one inert gas-arc, one selenium rectifier, and one motor-generator), two electric furnaces (6″ x 9″ x 16″ hearth size, 2000° F), four gas-fired furnaces (two for heat treatment, two for forging), 15 gas welding stations, one pyrometer panel (three instruments mounted), one squaring shear, one power hacksaw, and one Jominy-end quench equipment. The end-quench equipment, oil-, and water-quench tanks are portable, on casters.

Metallography Laboratory

Two courses in metallography, general and advanced, are offered during the third and fourth semester, respectively. In general metallography, 12 metal specimens are prepared for microscopic study. Several of these are photographed and the darkroom procedures carried out to produce photomicrographs which are mounted on laboratory reports by means of gelatin tissue in a dry-mounting press. In photomicrography, definite precautions are taken in making diaphragm settings on the metallograph and in determining correct exposure time. These procedures, as well as darkroom techniques, are entirely new experiences to students who have never before heard of this type of equipment. Usually, this type of laboratory experience is not offered in senior colleges until the third or fourth year. However, in technical education, emphasis is on the manipulative techniques while the interpretation of the microstructures is limited to the common ferrous alloys.

In the advanced metallography course, the laboratory techniques are further perfected. Special polishing procedures are practiced on alloy steels, gray cast irons, and wrought iron where silk cloth, wax-coated, or lead-surfaced polishing wheels are used. Diamond dust and several grades of alumina are employed as polishing mediums. Macroetching is practiced and a few samples are photomacrographed.

Some of the major pieces of equipment in the metallographic laboratory include two plastics mounting presses, one belt sander, two wet-cut-off machines, eight polishing wheel stations, one etchant bench, five bench microscopes (all have turret objectives, two have inverted stage), three metallographs (all are Bausch and Lomb made; one is a research model with brightfield, darkfield, or polarized light), one copy camera (Bausch and Lomb make, bench mounted), one spectroscope (Jarrel-Ash, three meter, grated), one densitometer, one calculating board. The darkroom contains all the necessary equipment including two enlargers (Omega D-II), one large drum print dryer, one small drum dryer, one print washer, one large and one small contact printer, photo trays ranging from large to small size, etc.

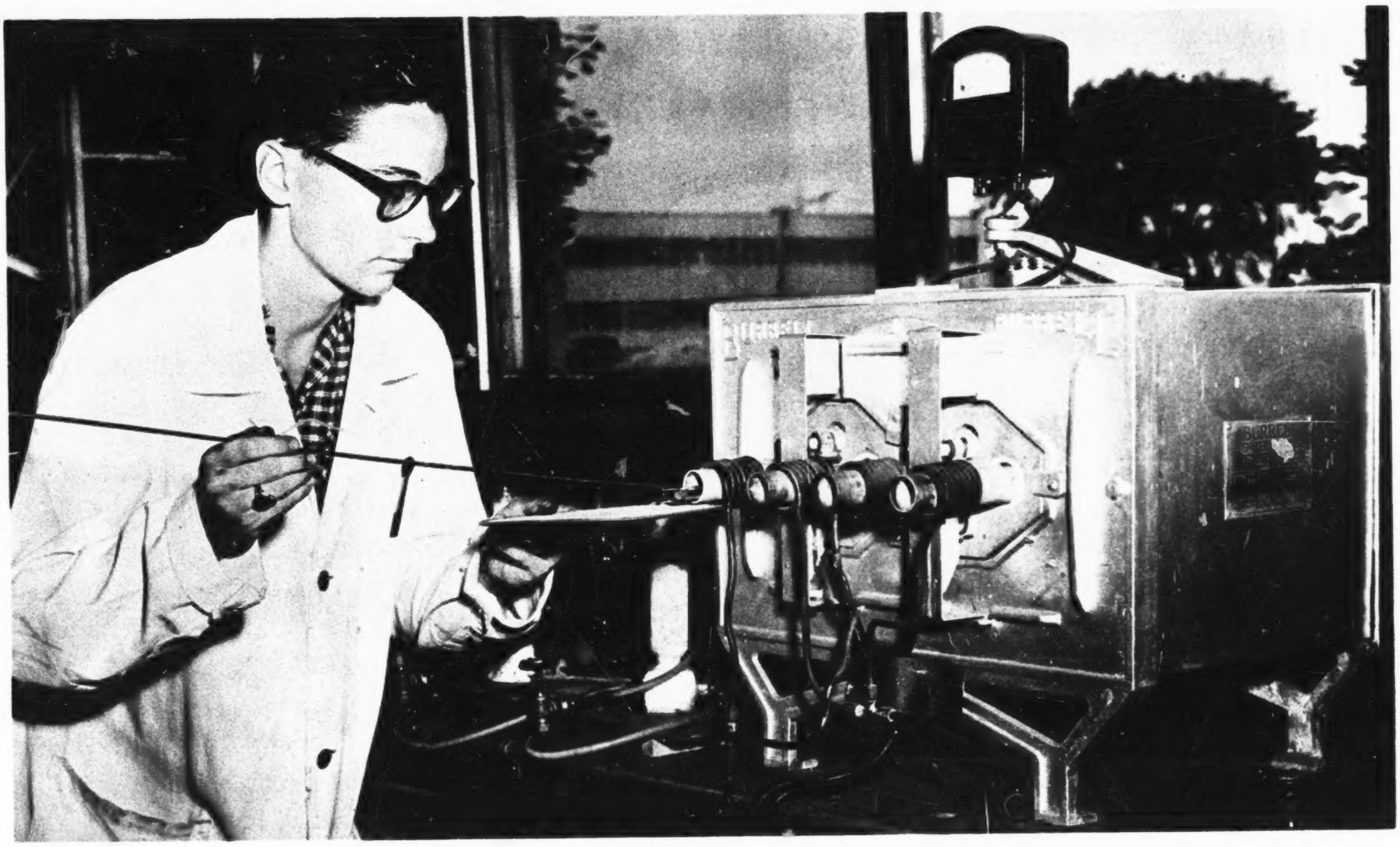
Mechanical Testing Laboratory

Training is given in operating the various machines that are used in industrial practice to make tension, compression, shear, bend hardness, fatigue, and impact tests. In elongation measurements during a tensile test, several different approaches are used; such as the divider method, the extensometer. A number of precautions are also observed in hardness testing where the factors of diameter, thickness, distance between impressions, surface conditions, and others must be specifically noted. The Sonntag fatigue tester can be adapted to three different fixture attachments —tension-compression, torsion, or reciprocating bend. Two different pendulums may be used with the impact tester, and an impact-tension attachment is also included in the accessories.

Some of the major pieces of equipment in the mechanical testing laboratory include one 60,000 lb. hydraulic universal tester (plus sets of fixtures for shear, transverse, and bend tests), one impact tester (plus two sizes of pendulum and impact-tension attachments), one Sonntag fatigue machine (sets of fixture: torsion, bend, tension-compression), five Rockwell hardness testers (one of these is a superficial model), two Brinell hardness testers (one is motorized), two Scleroscope hardness testers (one model D, one S), one horizontal tensile tester, one Equitron, one Do-All saw, two pedestal grinders.

Chemical Analysis Laboratory

With one semester of general chemistry as a prerequisite, the student is immediately introduced to the first three groups of metals in elementary qualitative analysis. The objective is to obtain some familiarization with qualitative techniques and alert the student to the principles of interfering elements in analytical procedures. In addition, laboratory practice in analytical weighing, the making-up of fractional normal solutions, standardization of solutions, and the



A four-tube furnace is used for combustion carbon analysis in the chemical-metallography laboratory.

Here a student is removing a nickel boat, which holds the metal sample, from the carbon combustion furnace.

selection of the correct grade of filter paper are some items that are stressed.

The specialized equipment used for this course, other than the usual chemical apparatus, are six electric hot plates, stainless steel, hooded and vented with downdraft blower; and a four-tube combustion furnace for carbon analysis. Six elements, carbon, silicon, sulfur, manganese, phosphorus, and chromium are quantitatively determined.

In the new building on the Fairlane Campus, the three metallurgical laboratories will be adjacent to one another and the metal processing laboratory will be located at the end of the building. This layout will permit an easy access for delivering heavy supplies. If a foundry area seems desirable in the future, expansion can be accomplished by a projection of one end of the building wing.

Equipment and Cost

About five-sixths of the equipment in the metallurgical laboratories was donated by the Ford Motor Company, the closed Henry Ford Trade School, or obtained from federal and war surplus. As a result, the metallurgy department has some deluxe models and types of equipment for which a new laboratory planner might find less expensive substitutes. From a previous study, the price of the equipment in each laboratory, based on its condition when received, was estimated as follows:

Chemical and metallographic laboratory	$13,800
Metallographs and photo darkroom	38,000
Mechanical testing laboratory	26,800
Metal processing laboratory	13,600
Total	$92,200

Entrance Requirements

Admission to the Community College requires the usual application, health form, and transcript from high school, as followed in most institutions. Residents of Dearborn may enter with a *C* average, but nonresidents must have a *C*+ average. The SCAT tests are given all entering freshmen. There are many instances of students wishing to pursue the engineering field while their test scores indicate their chances for success may be better by starting in one of the technical programs.

Job placements have been made in chemical, mechanical, metallographic, and X-ray testing laboratories for metals, heat-treat departments, production control, and electroplating, testing and inspection of castings in ferrous and nonferrous foundries, quality-control laboratory in rolling mills, and technical sales areas.

Representatives from all industries, colleges, and universities in the Detroit area hold membership in the American Society for Metals. Every spring the student members are invited to a College Night Banquet, where they have an opportunity to meet and socialize with the metallurgical supervisors from the Detroit industries. These supervisors are also invited to visit the college to acquaint them with the school's facilities.

Some of these industrial supervisors are also members of the Educational Subcommittee of the American Society for Metals. They have proposed the formation of an Explorers Post which has as its main objective to create interest in, and to help direct young men into, the metallurgical field. The Coordinator of Metallurgy at the College will serve as part-time adviser and assist the metallurgists of these companies in carrying out the student projects. This endeavor should have mutual benefits for both the leaders of the Explorers Post and the College and could be an important factor in increasing the enrolment in metallurgy.

General Appraisal and Anticipated Future

The Community College is controlled and supported by the Dearborn Board of Education and is an integrated part of the Dearborn public school system. A considerable portion of its financial support comes from local school district tax funds.

All of the graduates from the metallurgical program are employed in the metallurgical field except a few who are engaged in the armed services. A questionnaire sent to the graduates in the summer of 1961 revealed that their salaries ranged from $405 to $610 per month, with most in the $510 to $530 bracket. Job opportunities in the field have been increasing steadily, and the performance reports on these graduates are highly satisfactory. Reports from industry, the community, and the graduates show that the two-year program in metallurgical technology at the Henry Ford Community College is helping to meet the needs of this highly industrialized area.

Teaching Chemical Technology at Erie County Technical Institute

By E. Rexford Billings

Associate Dean,
Erie County Technical Institute,
Buffalo, New York

THE story of the chemical-technology curriculum at Erie County Technical Institute, Buffalo, New York, begins with a series of studies made during the early forties by the New York State Education Department to determine the need for trained personnel in various industrial-technical fields.

During 1944-45, the department engaged two part-time consultants in Western New York to develop an industrial-chemistry curriculum. These consultants visited plants in the area, met with the heads of various chemical laboratories, and held discussions regarding the skills and knowledge that would be required of technicians and laboratory assistants. At that time, there was no available supply of professionally trained laboratory technicians; all laboratory assistants and technicians were trained on the job. The plant visitations enabled the consultants to develop a list of manipulative skills needed, as well as an outline of content that had to be included in any program that attempted to train technicians for chemical laboratories. From this information a basic curriculum was drawn up.

The objective of this basic curriculum was to supply the information needed for a technician to become employed in a beginning job and to progress to more advanced positions. Also, it was hoped to provide training sufficient to develop the skills necessary for various laboratory procedures and thus enable the technician to become productive in the early stages of his employment. A part of the task in developing a curriculum was to furnish a plan of suggested laboratory space, including attendant equipment, and a compilation of suitable texts and reference material.

In 1946 the legislature of the State of New York established an Institute of Applied Arts and Sciences at Buffalo as one of five, tuition-free, two-year technical institutes for high-school graduates. One of the curriculums offered at the new school in Buffalo was the program in industrial chemistry which had been developed during the previous two years. (On September 1, 1953, the Board of Supervisors of Erie County assumed the sponsorship of the Buffalo Institute and its name was changed to Erie County Technical Institute.)

Although the chemical-technology program at Erie County Technical Institute is designed basically to train the student to earn a living as a technically employed individual in the chemical industry or any other chemical-laboratory position, the program includes subjects in general education areas to enable the student to broaden and deepen his base of understanding of today's complex world.

To be admitted to the chemical-technology curriculum at Erie Tech, the prospective student must be a high-school graduate recommended by his principal, make formal application including the State University of New York Admission Test, and show evidence that he is physically qualified to meet the course requirements. In some cases a personal interview is held. Probably the most important factor in weighing an application is a good high-school background in mathematics and science.

Because the students are trained both for jobs in the usual type of chemical laboratories and also for positions in private plant and development work, including introduction as production supervisors, the program contains courses which give training in both of these areas; students take many courses in chemistry as well as in chemical engineering subjects.

Courses Offered

The technical training is divided into three main areas of emphasis: analytical chemistry, organic chemistry, and unit operations.

In analytical chemistry, students take two courses in quantitative analysis, after suitable preparation in general chemistry courses. After completion of the quantitative analysis courses, students are required to complete two terms of instrumental methods of analysis.

Two terms of organic chemistry are required for the students after they have covered sufficient background material.

The unit operations area contains three terms of unit operations courses consisting of both classroom and laboratory work, as well as two terms of physical chemistry courses.

The courses offered follow the usual college level of instruction, and the texts used are those commonly found in most American colleges and universities.

The general education courses are communication skills, social studies, mathematics, and physics. In communication skills, the students cover such subject matter as rhetoric and composition, logic, and technical report writing. Social studies include economics, social science, sociology, and industrial and labor relations. All of these are important because the majority of students completing the program eventually work into supervisory positions. The mathematics and physics areas require the completion of courses in calculus as well as the usual basic college physics.

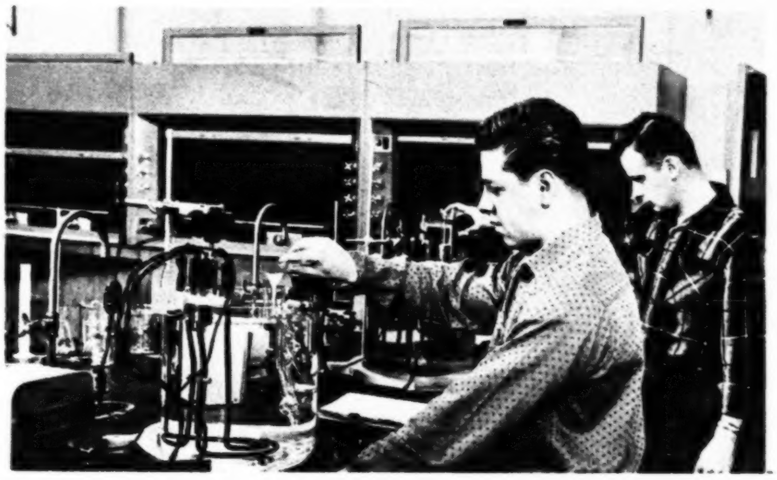
Two chemical-technology students at Erie County Technical Institute check infra-red absorption measurements in the instrumental analysis laboratory.

The laboratory facilities in the chemical-technology department at Erie Tech consist of a series of laboratories grouped around a central stockroom and supply area. All are modern, complete, and fully equipped for their purposes. The general chemistry laboratory is large enough, and has lockers of sufficient number, not only for teaching all of the general chemistry classes required for the chemical technology curriculum, but also to handle all of the service courses in general chemistry for the other curriculums on the campus.

The organic chemistry laboratory is designed so that students have materials and working space to do all work individually. This keynote of individuality is found throughout all of the laboratories in the department. It is felt that students doing their work on such a basis can better develop the techniques required for both entrance jobs and for promotion to more advanced positions.

The laboratory work in instrumental methods of

In the analytical chemistry laboratory, weighing is done on the latest type balance.



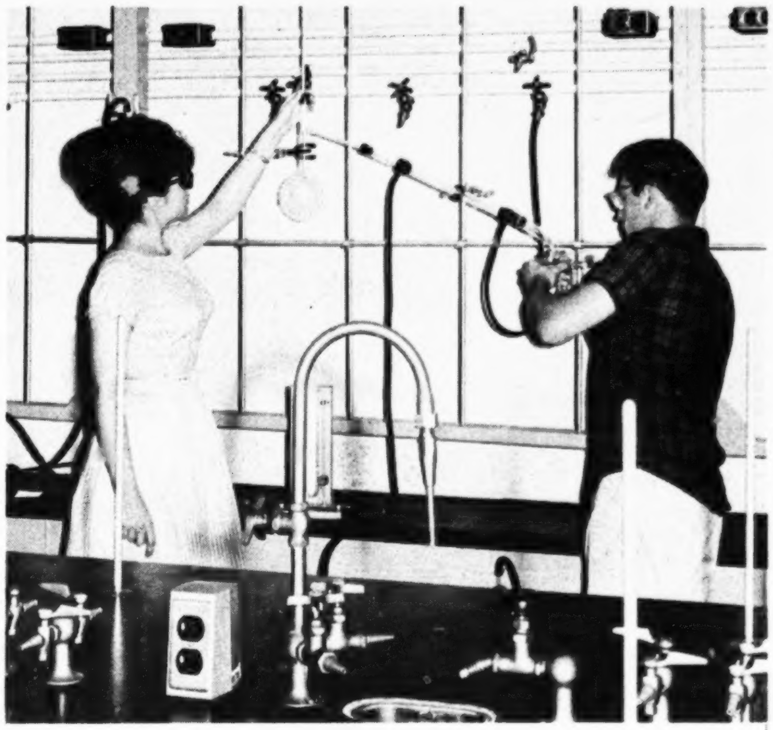
Two students measure viscosity in the physical chemistry laboratory at Erie County Technical Institute.

analysis involves the use of such instruments as colorimeters, spectrophotometers (including the latest infra-red recording models), chromatographs, and polarographs. The unit operations or chemical engineering laboratory is equipped with pilot plant-sized equipment such as heat exchangers, fluid flow apparatus, bubble cap stills, and filter presses.

The analytical laboratory area is composed of an air-conditioned balance room on one side and an air-conditioned instrument room on the other side. This is in keeping with the principle of having the most modern equipment throughout.

Work-Study Plan

A feature of the chemical-technology curriculum at Erie County Technical Institute is the cooperative work-study plan. Under this plan, a student spends approximately 36 weeks in school and 12 weeks in industrial experience each year. The industrial experience in local industry seeks to relate training received in classes and laboratories to actual employment in industry. The advantages of the plan are many and varied. For one thing, the plan enables the student to acquire technical skills and information to complement his technical knowledge acquired in school. Because the work experience is directly related to the program in which he is enrolled, the student develops a feeling of selfdependence and responsibility and the realization that each job in the laboratory must be completely performed.



The laboratories are large, modern, and are fully equipped for the particular purposes of the laboratory.

Other advantages of the cooperative work-study plan are that it gives the student an opportunity to relate and evaluate the school instruction in terms of practical usage in the chemical laboratory; it gives the student an opportunity to earn wages while attending school; and it helps him to realize that personal qualifications such as industriousness, loyalty, dependability, and the ability to work with others are as necessary for success as technical knowledge and skill.

The program in chemical technology at Erie County Technical Institute has always enjoyed a high degree of cooperation from the industries of the Western New York area. Most of the chemical laboratories along the Niagara Frontier have found that Erie Tech graduates are valuable additions to their staffs. Probably part of the success in placing graduates in local industries is due to the fact that the local industries have been represented in the program as it was initially planned and as it is currently operated. The chemical technology program has always been managed with the aid of an advisory committee from local industry. These representatives of chemical laboratories, originally called on to help plan the program, continue to re-evaluate objectives and course content.

Graduate Opportunities

In general, graduates of the chemical-technology program have opportunities for positions prior to graduation. Job opportunities are now spreading throughout the United States, with many companies from coast to coast recruiting prospective Erie Tech graduates. Naturally the highest percentage of graduates is placed in local industry. However, an increasing number move to areas farther and farther away as the demand for professionally trained technicians increases.

An interesting development that might be noted is that transfer to four-year university programs is increasing steadily. Most graduates with good grades from the Erie Tech program can now receive two-year transfer credit to almost any four-year program they wish to pursue. About 20 percent of the graduates transfer to such a program immediately. Eventually, about 60 percent of the chemical technology graduates of Erie County Technical Institute continue their academic careers at other institutions of higher learning.

Two factors are fundamental in compiling this record. One is a sound standard of academic excellence and the other is the faculty.

In the final analysis, the reputation of the chemical-technology program at Erie Tech rests with the record of its graduates. Standards of academic endeavor must be maintained so that when graduates are placed in industry or transfer to more advanced programs they will perform in the manner expected of them.

The core of any teaching-learning situation is the faculty. Each of the instructors in the department has a teaching, technical, or engineering degree combined with a considerable period of industrial experience. The faculty members are continually studying to keep abreast of the latest technical developments and advancements made in industry. They are aware of the type of training needed by technicians and are constantly changing their courses to meet these needs. The chemical-technology curriculum at Erie County Technical Institute carries E.C.P.D. accreditation from the American Society of Engineering Education.

In summary, the chemical-technology program at Erie County Technical Institute is the outgrowth of a survey of the chemical industries along the Niagara Frontier. While it has been primarily designed to give the students training in the type of equipment common to the chemical plants of that particular area, the need for technicians everywhere has given the program an impact that is national in scope.

On completing the two-year program and receiving the degree of Associate in Applied Science, graduates are qualified to hold a variety of positions in the chemical field. Lack of space prohibits a complete enumeration. However, some of the job titles presently held by chemical-technology graduates of Erie Tech are research technician, analyst, laboratory technician, shift chemist, control chemist, control technician, spectrographic technician, laboratory group leader, and sales development technician.

The chemical field is relatively young in the scientific scheme of things and is constantly changing. New discoveries are being made continually. Chemical technology and the need for professionally trained technicians will continue to grow. The outlook for technical education in this field is that of uninterrupted expansion.

Training Civil Technicians at Oregon Technical Institute

By W. M. Douglass and W. D. Purvine

Administrative Dean, and President, respectively,
Oregon Technical Institute,
Klamath Falls

"AN ideal surveying laboratory." This is an appropriate description of the 822-acre Oregon Technical Institute campus nestled in the hills outside of Klamath Falls. The description was suggested by a visiting engineer some time ago. Elevations on the campus, exceeding variations of 1,000 feet, provide an ideal location for the civil-technology curriculum at the Institute. All four majors—drafting technology, highway technology, structural-design technology, and surveying technology—provide a strong basic surveying program in a "common" first year.

The identical content in the first of these two-year programs provides a broad foundation on which to build each of the civil-engineering technician majors. An outline of the course and content for this first year follows. (Sequence and content of the various majors and options during the second year are reported in their appropriate places in this article.)

CIVIL TECHNOLOGY (FIRST YEAR)

	Hours			
Course	*Lec.*	*Lab.*	*Credits*	*Term*
Engineering Drawing	2	7	4	1
Trigonometry	4	0	4	
Fundamentals of Surveying	2	8	5	
English Composition	3	0	3	
			16	
Civil Drafting	2	4	3	2
Surveying Computations	2	3	3	
Strength of Materials	3	2	4	
College Algebra	4	0	4	
English Composition	3	0	3	
			17	
Route Surveying	2	7	4	3
Strength of Materials	3	2	4	
Technical Report Writing	3	0	3	
Physics	3	2	4	
Elective			3	
			18	
Total			51	

The program is designed to supply technical assistants for professional civil engineers. It was started with structural-design and surveying majors in 1943 at the request of governmental units and engineering and construction firms. In 1957, the highway-technology major was added at the request of the State Highway Department and other interested groups. Drafting technology, both the architectural-structural option and the mechanical option, was started in 1958 after repeated requests from industry. There are now 41 full-time students enrolled in the program. There are 1,000 students attending the Institute.

The common first year for each of the four majors provides a sound and basic background. It is the result of ten years of study by an advisory committee and the department's eight faculty members. Our experience has indicated to us that fundamentals studied in the first three terms (three terms per year) are requisites for any area of specialization. Mathematics, physics, and English composition are taught outside of the department in the Division of Allied Arts and Sciences.

Students are accepted if they are high-school graduates and if they achieve a minimum score on the Engineers' and Physical Science Aptitude Test. Other placement tests are also used. Although not an entrance requirement, high-school experience in physical sciences, mathematics, and drawing is strongly recommended.

Students attend school from 26 to 30 hours per week, depending on the term and major-study area. Elective courses are required in the second set of three terms the student is in school. Students elect courses such as the following: advanced mathematics or physics, chemistry, industrial relations, human relations, typing, machine shop, or other special courses arranged in the curriculum of the school.

Drafting Major

The outline for drafting technology is as follows:

DRAFTING-TECHNOLOGY MAJOR (SECOND YEAR)

	Hours			
Course	*Lec.*	*Lab.*	*Credits*	*Term*
Strength of Materials	3	2	4	4
Mechanisms	2	4	3	
Machine Drafting	2	7	4	
Materials & Processes	3	2	4	
General Physics	3	2	4	
			19	
Fluid Mechanics	2	3	3	5
Machine Design	2	7	4	
Technical Drawing	2	7	4	
Elective			3	
			14	
Advanced Machine Design *	13	12	7	6
Control Systems	2	3	3	

*Technical Illustration—
Students who have the interest and aptitude may take this course in place of Advanced Machine Design.

Human Relations	3	0	3
Elective			3
			16
Total			49

Drafting instruction in the second year includes advanced work as follows: Sketching, section, pictorial, dimensioning, detail drawings, tracing, and lettering. Students also receive instruction in auxiliary projection, threads and fasteners, intersection and development, conventional representation and American Standards Association representations and symbols. Accuracy in determining dimensions and tolerances is thoroughly emphasized.

Highway Major

Course content for the highway major is fairly well indicated in the course titles in the following course outline:

HIGHWAY-TECHNOLOGY MAJOR

	Hours			
Course	*Lec.*	*Lab.*	*Credits*	*Term*
Concrete Practice	3	4	4	4
Geodetic Surveying	2	6	4	
Highway Surveys	2	6	4	
Elective			4	
			16	
Asphalt Paving	2	6	4	5

Fifth-term civil technology students at Oregon Technical Institute make a topographic survey with a theodolite.

Surveying-technology students plot control for topographic map of a proposed campus site.

Photogrammetry	1	3	2	
Contracts & Specifications	3	0	3	
Physical Geology	2	3	3	
Mapping & Computing	2	8	5	
			17	
Fluid Mechanics	2	3	3	6
Soil Mechanics	2	6	4	
Highway Organizations & Planning	3	0	3	
Construction Surveys	2	6	4	
Elective			3	
			17	
Total			50	

Thorough theoretical and laboratory training is given these technician trainees in soils, asphalt, and concrete. Factors related to highway base materials and road-bed soil characteristics are studied.

Surveying is a basic technique in highway technology. Highway design includes study of paved and concrete surfaces, drainage, elements of structures, bridge construction, and planning of freeways, traffic dividers, and interchanges.

The broad experience of all of the specialists on the civil technologies faculty is brought to the highway technology student in the areas of fluid mechanics, drafting, surveying, strength of materials, physical geology, and contracts and engineering specifications.

Structural-Design Major

The course outline for the structural-design major follows:

STRUCTURAL-DESIGN TECHNOLOGY MAJOR

Course	*Hours* Lec.	Lab.	*Credits*	*Term*
Structural Analysis	3	2	4	4
Steel Structures	2	3	3	
Concrete Practices	3	4	4	
Electives			7	
			18	
Fluid Mechanics	2	3	3	5
Structural Timber	2	3	3	
Structural Drafting	2	6	4	
Physical Geology	2	3	3	
Welding Processes	3	6	5	
			18	
Reinforced Concrete	2	3	3	6
Soil Mechanics	2	6	4	
Contracts and Specifications	3	0	3	
Construction Surveys	2	6	4	
Elective			3	
			17	
Total			53	

Once again course titles are indicative of content. (A good deal of emphasis is given to timber structures since Oregon is the nation's "number one" logging and lumbering state.) Special emphasis is given in this area to prepare graduates to aid the structural designer, contractor, architect, or manufacturer of construction materials. Materials testing and research technician employment has been a secondary objective.

Surveying Major

This major has been given special recognition by the Oregon State Board of Engineering Examiners. The board allows the experience gained in this program to be used toward completion of the requirements for Registered Land Surveyor. The second-year program follows:

SURVEYING-TECHNOLOGY MAJOR

Course	*Hours* Lec.	Lab.	*Credits*	*Term*
Geodetic Surveying	2	6	4	4
Highway Surveys	2	6	4	
Topographic Surveying	2	7	4	
Elective			4	
			16	

Mapping and Computing	2	6	4	5
Physical Geology	2	3	3	
Legal Aspects of Surveying	3	0	4	
Subdivisions	2	8	5	
Elective			3	
			19	
Photogrammetry	1	3	2	6
Construction Surveys	2	6	4	
Professional Surveying Practice	2	6	4	
Fluid Mechanics	2	3	3	
Elective			3	
			16	
Total			51	

In a sense, this major can be considered the basic one out of which the others have grown or will grow. The level, transit, and drawing board are still the basic tools of the civil engineer and his aide, the civil-engineering technician. The "natural laboratory" provided by the campus, surrounding ranches, and many roads allows the application of basic skills and "tools." Plane surveying, office engineering, mapping and computing, drawing, and legal aspects of surveying are given special treatment.

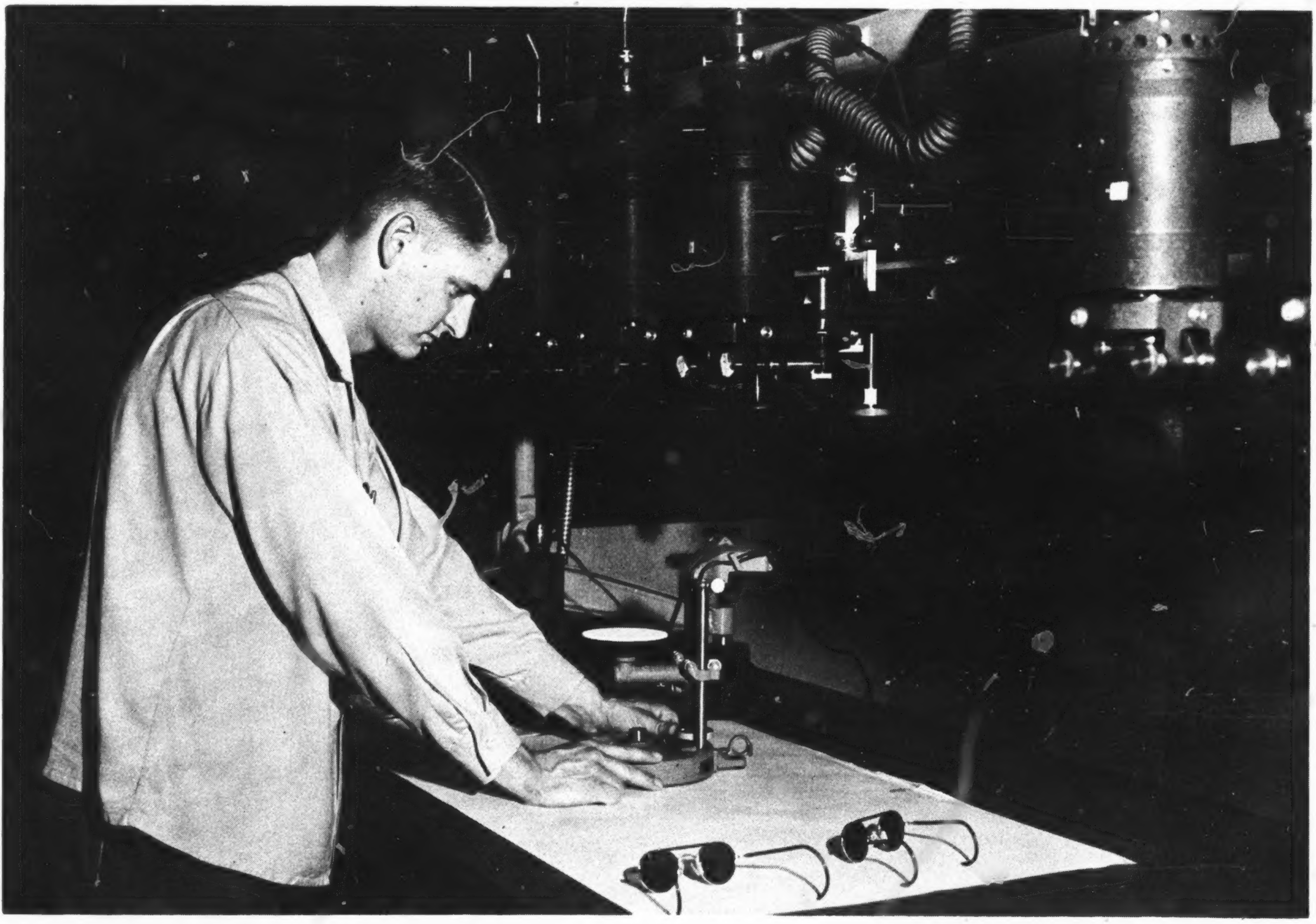
Facilities and Equipment

The Institute is located at a former U.S. Marine Corps barracks that was built originally to serve as a hospital and rehabilitation center. The barracks-type buildings, as well as other special-purpose buildings, have been adapted for educational purposes.

An adequate supply of foreign and domestic levels and transits, alidades, theodolites, Rhodes arcs, plane tables, rods, and chains are available for surveying instruction. The multiplex photogrammetry projector permits instruction in this recent technique.

A large quonset hut has been converted to a highway and structural laboratory for instruction in soils, asphalt, and concrete. Equipment in the lab provides for tests or experiments in mechanical analysis, specific gravity, compaction, consolidation, tri-axial shear,

A fifth-term highway-technology student is shown here operating a multiplex in photogrammetry.



penetrometer, viscosometer, flash and fire, distillation, stability, versa-tester, loading, ductilimeter, and emulsion retorts. Cement and concrete-testing equipment is also provided. Many cooperative projects and experiments are carried on with other curriculum areas such as machine shop, welding, electronics, and metallurgy.

Drafting rooms with special tables and machines are provided along with several reproduction processes. The usual classrooms are provided with tables for computation work. The Institute's library contains reference books and periodicals. It is located near the civil-technology buildings.

Employment Opportunities

Instruction in the broad, basic fields included in the curriculum provides preparation for several semiprofessional job clusters. Surveying allows the graduate to find employment in cartographical, construction, highway, railroad, or registered-land-surveyor areas. The broad scope of drafting prepares the student to specialize in architectural, structural, or mechanical drafting, or design. Graduates may work as inspectors in several areas: soils, asphalt or concrete technicians, estimators, computers, contractor's assistants, or others.

Approximately 95 percent of the graduates of civil technology are employed in the work for which they were trained, or in closely related work. Graduates usually have a relatively wide choice of jobs to go to. Beginning salaries range from $400 to $475 per month. Approximate employment distribution is as follows: one-third—federal government; one-third—state, county, or municipal governments; and one-third—private industry.

Dropouts from the program have averaged about 30 percent each year. A special preparatory program of one or two terms has been added to help new students make up deficiencies. Experience to date indicates this program will save some students who otherwise would fail.

Relations with Industry

The success of the graduates on their jobs has "sold" the program to industry. A formal advisory committee for the curriculum is consulted. Frequent contacts are made with government and private industry for additional advice and counsel. The advisory committee has representation from contractors, Oregon State College, governmental agencies, the state engineering board, and architects. Recruiting teams, as well as individual employers, frequently visit the campus to hire students. Manufacturers, distributors, private firms, and governmental agencies send representatives to the campus to serve as guest lecturers and to present demonstrations.

The Future

The interest in the civil-technology curriculum by employers and prospective students will probably continue the trend of increased enrolment each year. Faculty members are enthusiastic and strive continually to improve the program. No two successive years have found courses and content exactly the same. The general trend has been toward broader courses without sacrificing the practical aspects of specialization.

If current national and international conditions continue, there is little doubt that civil technology will continue to be one of the most popular curriculum areas at the Institute.

Training Data-Processing Technicians in North Carolina

By Ivan E. Valentine

Assistant Director, Vocational-Technician Division,
Department of Community Colleges,
State Board of Education,
Raleigh, North Carolina

ONE of the most important and rapidly growing fields in this age of space exploration and space travel is electronic data processing. The rapid growth in this technology has provided a means of processing masses of scientific and business data utilizing computers and peripheral equipment. The demand for trained technicians in this important field has created a serious shortage for highly trained, qualified technicians at all levels from the card-tape-converter operator to the system analyst and the supervisor of data-processing systems. There is a growing need for more and better technically trained personnel to assist the engineer and scientist in carrying on production and research projects.

North Carolina has developed 20 area schools with the specific function of offering quality instruction which will prepare selected individuals for entrance into, and progress in, technical and industrial pursuits. The technical skills acquired in data processing and other technical areas will enable more of our citizens to contribute substantially to our social and economic society. By the same token, the area's overall cultural growth will be greatly improved.

Industrial growth and technological changes in new and existing industries, as well as extensive business expansion in North Carolina, have created a critical shortage of trained personnel for data processing centers. Management in research and the production of electronic equipment have given full support to this new training program. Life insurance companies and banks, as well as numerous state agencies, have contributed a great deal of time and effort in developing this important new technical training program.

The American Society of Tool Engineers of North Carolina has made several requests for formal training for technicians to operate and maintain tape-controlled production machines, a recognized integral part of our rapidly expanding industrial status. The development of such special training to meet the need for automation in industry has gained the support and respect of the machine-tool industry in this geographical area.

The educational requirements for technicians in these positions are rigid. The technician must have a thorough knowledge of mathematics, accounting, business procedures, office machines, statistics, and electronic data processing (EDP) equipment.

Entrance Requirements

In general, the training is designed for those who place in the upper third of their high-school gradu-

A student in the data-processing program at Burlington Center working on an IBM 1620 Computer.

ating class. In some instances, the individuals who enrol have earned credit from college courses or may have earned degrees from recognized colleges or universities. They have elected to enrol in the training program as a tool to enable them to achieve specific goals in data processing.

Ideally, the entrance requirements for this program should be high-school graduation and should include two years of algebra, one year of geometry, and one-half year of trigonometry. A more realistic view of entrance requirements would be: high-school graduation with one year each of algebra and geometry. Requirements might have to be adjusted in light of local conditions. Deficiencies might require an adjustment of the program or provision for remedial work. All students selected for this training must pass the IBM Test for Programers, in addition to completing the testing program for admittance to the school, which includes the GATB and DAT series. Both men and women are considered as applicants for this technical training.

The data-processing program is offered in Burlington Industrial-Education Center and in three other area vocational-technical schools in the state, on a full-time day program, six hours a day for two years. This same program is offered on a part-time basis in the evening program. Extension courses are offered in the evening and on Saturdays for those who desire short intensive units in data processing.

Two Courses Offered

The EDP program in these schools offers training for programing in business-data and scientific-data processing. The over-all objectives for this program as set forth by the consultant committee in Burlington are as follows:

1. To provide a progressive program which will develop desired skills and special abilities in all levels of data processing.
2. To develop a program to meet the needs of students: (*a*) pre-employment technician training offered to post-high-school students both in the day and evening programs; (*b*) in-service or updating programs for personnel of existing data-processing centers; and (*c*) special courses for engineers seeking EDP training.
3. To meet the needs of students in providing formal training in data processing for business and scientific fields.
4. To provide the student with a solid background in the scientific methods: business administration, industrial procedures, economics, engineering mathematics, science, and basic electronics technology.
5. To include special courses, workshops, and seminars for accountants, office managers, and other interested groups. (Courses to be offered on a need basis as determined by local industries and businesses served.)
6. The curriculum shall place emphasis on systems and procedures for data-processing application methods, rather than specific machines or their operation.

The consultant committee and the instructors at Burlington Center have developed the curriculums for two courses—scientific-data-processing technology and business-data-processing technology. These curriculums are subject to revision as we gain experience in

An over-all view of the computer laboratory at Burlington Center. Data-processing technology is an area of training in which young ladies are welcomed.

operating this new program. (It should be understood that a duplication of the Burlington program exists in three other area vocational-technical schools in the state.)

Scientific-Data-Processing Technology

The curriculum of the scientific-data-processing course is designed, especially in the second year, to assist students to prepare for the new techniques in the processing of data by electronic equipment in scientific research and industry. It stresses mathematics in each of the six quarters of work.

The program aims to provide graduates who are qualified to: apply currently available programing techniques to a defined problem with minimum supervision; to program and operate any computer with a minimum of orientation; to understand and master special techniques as the need occurs; and to communicate their properly documented programing decisions to personnel involved. Machines are used in the solution of research, production, and engineering problems.

The suggested curriculum by quarters is as follows:

Course Title	*Course Hours Per Week Class*	*Lab.*	*Quarter Hours Credit*
First Quarter			
Numbering System and Boolean Algebra	5	0	5
Functional Wiring Principles	4	6	7
Business Machines	0	4	2
Communicative Skills: Reading Improvement	2	0	2
Introduction to Data-Processing Systems	3	2	4
	14	12	20
Second Quarter			
Algebra	5	0	5
Fundamentals of Programing	5	0	5
Physics: Properties of Matter	3	2	4
Industrial Organization and Management	3	0	3
Communicative Skills: English	3	0	3
	19	2	20
Third Quarter			
Trigonometry	5	0	5
Business Programing	2	4	4
Physics: Work, Energy, Power	3	2	4
Statistics	5	0	5
Communicative Skills: Technical Writing	3	0	3
	18	6	21
Fourth Quarter			
Differential Calculus	5	0	5
Scientific Programing	2	4	4
Physics: Light and Sound	3	2	4
Statistics	5	0	5
Communicative Skills: Speech	2	0	2
	17	6	20
Fifth Quarter			
Integral Calculus	5	0	5
Linear Programing and Critical Path Method	2	4	4
Chemistry	3	2	4
Economics	3	0	3
Electrical Fundamentals	3	2	4
	16	8	20
Sixth Quarter			
Differential Equations	5	0	5
Chemistry	4	2	5
Introduction to Electronics	3	2	4
Human Relations	2	0	2
Research Project	5	4	7
	19	8	23

The graduate of the scientific-data-processing technology course should be a specialist equipped for the following job description: analyze and define requirements to develop program for electronic data processing; conduct detailed analyses of systems re-

Four young ladies working in the wiring section of the data-processing laboratory at Burlington Center.

quirements, and develop all levels of block diagrams and logical flow charts; translate program details into coded instruction; develop and prepare plans; establish test data; test, refine, and revise the program; and evaluate and modify existing programs as procedures or content of reports change.

Business-Data-Processing Technology

The curriculum of the business-data-processing course is designed to give the student an understanding of the principles of business operation; experience with techniques of handling business data; functional competence in the application of data-processing systems; and experience in computer programing of business records and accounts, inventory, sales, and income and expenditures essential to business and to management decisions. Machines are used in solving business problems.

The suggested curriculum by quarters is as follows:

Course Title	*Course Hours Per Week*		*Quarter Hours*
	Class	*Lab.*	*Credit*
First Quarter			
Numbering System and Boolean Algebra	5	0	5
Functional Wiring Principles	4	6	7
Business Machines	0	4	2
Introduction to Data-Processing Systems	3	2	4
Communicative Skills: Reading Improvement	2	0	2
	14	12	20
Second Quarter			
Algebra	5	0	5
Fundamentals of Programing	5	0	5
Accounting	5	2	6
Communicative Skills: English	3	0	3
Industrial Organization and Management	3	0	3
	21	2	22
Third Quarter			
Trigonometry	5	0	5
Business Programing	2	4	4
Accounting	5	2	6
Statistics	5	0	5
Communicative Skills: Technical Writing	3	0	3
	20	6	23
Fourth Quarter			
Scientific Programing	2	4	4
Accounting	5	2	6
Statistics	5	0	5
Communicative Skills: Speech	2	0	2
Calculus	3	0	3
	17	6	20
Fifth Quarter			
Cost Accounting	4	2	5
Linear Programing and Critical Path Method	2	4	4
Economics	3	0	3
Chemistry	3	2	4
Electrical Fundamentals	3	2	4
	15	10	20
Sixth Quarter			
Business Law	5	0	5
Machine Accounting Problems	0	4	2
Practical Accounting Problems	0	10	5
Research Project	5	4	7
Human Relations	2	0	2
	12	18	21

The job description for the business-data-processing technician would be: He applies currently available programing techniques to a defined problem with minimum supervision. He analyzes and defines systems requirements to develop a program for electronic data processing, conducts detailed analyses of systems requirements, and develops all levels of block diagrams and logical flow charts. He translates program details into coded instructions; establishes test data; and tests, refines, and revises the program and documents the procedures. He ascertains if other combinations of instructions would achieve greater flexibility, better machine utilization, or more dependable results. He may prepare a complete set of operating instructions for use by a console operator and, on occasion, may operate the console in the processing program.

Meet Specific Needs

These data-processing curriculums, as all other technical offerings, are designed to meet the specific needs of students. This new type of technical training was initiated on the basis of results of a state-wide survey for determining the need for trained technicians in data processing. The training in all areas is designed to improve the individual's economic, social, and cultural standing in a modern industrial society. The curriculums are so organized to provide flexibility to meet the needs of the changing industrial structure of North Carolina.

Classes for the full-time EDP program start at 8:30 A.M. and run until 3:30 P.M. Evening classes are scheduled from 6:00 P.M. until 10 P.M. All classes are offered on a five-day schedule. The area-school program in North Carolina operates on a 12-month basis. This type of operating schedule insures maximum use of equipment and facilities.

There is no tuition charged for training in the program. An instructional fee of $10 per month for full-time students, plus the cost of texts, are the only costs to the student. Part-time students pay an instructional fee of $7.50 per month.

The facilities for housing the EDP Program at Burlington Center were designed by IBM Data-Processing Division planning engineers. One thousand square feet of floor space is provided for the computer laboratory. The floor of the laboratory includes a Met-L-Strut raised-floor system with adjustable pedestals and floor panels. Power for all equipment is installed under this specially constructed floor. The laboratory is fully air-conditioned and humidity controlled. The acoustical ceiling of sponge sheet Curon and specially treated wall surfaces provide the physical control desired for EDP equipment. Included also is an EDP classroom, panel wiring section and library, providing an additional 1,000 square feet for the special related instruction.

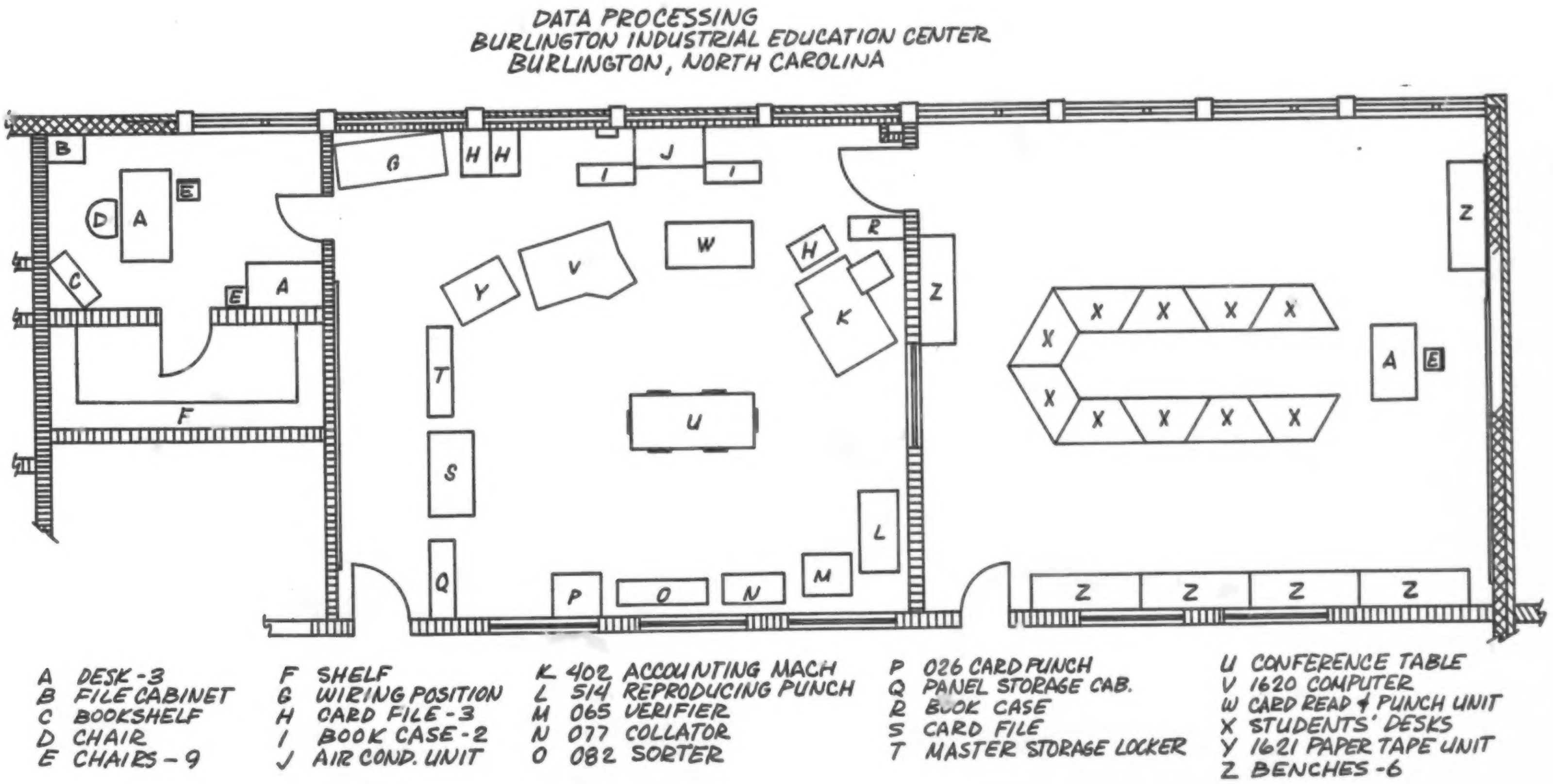
Office space for two instructors and adequate storage facilities have been provided. The splendid cooperation of IBM consultants, school architect, and the state consultant committee makes this one of the finest EDP laboratories to be found in a school of this type.

Selection of the best equipment for the data-processing program and this type of training presented many problems. The major factors included selecting equipment which could be used effectively in teaching data processing for both scientific and business programing. There was the problem of selecting equipment from the many different manufacturers of the highly specialized equipment. The question of leasing versus buying EDP equipment had to be solved, an important factor being the special discounts made by some manufacturers of this equipment. The proposed service, assured by the manufacturer after the installation, needed consideration. The delivery, installation, service, and maintenance agreement needed thorough study.

After much deliberation by all concerned, the State Board of Education approved the purchase of major EDP equipment and the leasing of peripheral equipment. This was decided to be the best approach to solving the equipment problem. The selection, as recommended by the consultant committee after all factors were weighed, was IBM equipment. There are several other manufacturers of EDP equipment that could serve the needs of an installation of this type.

The use of the EDP equipment is confined to the instructional program. The present plans do not call for any outside projects involving the equipment. It

A floor plan of the data-processing laboratory at Burlington Industrial Education Center.


DATA PROCESSING
BURLINGTON INDUSTRIAL EDUCATION CENTER
BURLINGTON, NORTH CAROLINA
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Z Z Z Z
A DESK-3
B FILE CABINET
C BOOKSHELF
D CHAIR
E CHAIRS-9
F SHELF
G WIRING POSITION
H CARD FILE-3
I BOOK CASE-2
J AIR COND. UNIT
K 402 ACCOUNTING MACH
L 514 REPRODUCING PUNCH
M 065 VERIFIER
N 077 COLLATOR
O 082 SORTER
P 026 CARD PUNCH
Q PANEL STORAGE CAB.
R BOOK CASE
S CARD FILE
T MASTER STORAGE LOCKER
U CONFERENCE TABLE
V 1620 COMPUTER
W CARD READ & PUNCH UNIT
X STUDENTS' DESKS
Y 1621 PAPER TAPE UNIT
Z BENCHES-6

is felt that the equipment can be used most effectively in the instructional program. Some schools buy or lease the EDP equipment to be used primarily as a tool for school records, grades, accounting, and scheduling. Under this type of program, the instructional training is in a secondary position to the use of the equipment.

The philosophy in North Carolina is that the instructional aspect has priority over any outside use of the equipment. Experience has shown that we are using our equipment 88 percent of the time in the instructional program. The remaining 12 percent is confined to workshops and seminars for interested groups.

Equipment

The following is a list of the equipment for the EDP program at Burlington Center:

IBM 1620 Card System and Paper Tape; 1620 Computer (with automatic divide); 1622 Card-Read Punch; 961 Tape Punch (paper); 1621 Paper Tape Reader; 062 Alphabetical Card Punches; 056 Alphabetical Verifier; 082 Sorter; 402 Accounting Machine; 514 Reproducing Punch with Summary Punch; and a 077 Numerical Collator.

The cost of the equipment for this laboratory was approximately $109,000.

Key punches and card-sorting equipment being used in the existing engineering-secretary and technical-secretary curriculum supplement EDP equipment in the computer laboratory.

It might be well to point out that North Carolina has 20 area schools. The local school unit provides the physical facilities, and the state provides all equipment, instructional costs, and one-half of the operating costs of the industrial-education centers (area schools). This program has been called "The Working Man's University," and rightfully so, as it provides educational opportunities for all who have the sincere desire to continue their education.

Many problems arise in the attempt to provide instructional staffing for this highly technical field. Lack of availability of competent instructors is one of the biggest problems in developing and projecting an EDP program. Offering EDP training for both scientific programing and business programing increases the complications.

The Burlington Center has three full-time instructors teaching these two areas. First, the instructor for scientific programing must have an engineering degree, and three to five years experience in the scientific-data-processing field. Advanced degrees are desirable. The instructor for business-data processing must have an advanced degree in business administration, and three to five years of practical experience in business-data processing. The third instructor must have an advanced degree in mathematics and a minimum of two years of practical experience in the engineering field or research area. Courses in related areas of EDP are taught by other full-time personnel at the Center.

Evening instructors are system analysts or EDP supervisors who meet all the above qualifications. The supply of part-time instructors for EDP in the Burlington Center is plentiful. They come from the electronics industry, textiles, insurance companies, and banking institutions in the area. Many women make excellent instructors for data processing. Sex is not a factor in the selection of instructors.

It is expedient that all instructors up-date themselves from time to time. IBM has been most cooperative in arranging for the instructors to attend any of their schools on EDP equipment. Each instructor has attended three such schools within the past year. This will be a continuous training program for data-processing instructors in the Burlington Center.

The development of this program was assisted by Dr. Walter M. Arnold, then director, Area Vocational Education Branch, U. S. Office of Education, Washington, D. C. The cooperation of the State Department of Public Instruction, division of vocational education, consultant committees, local school authorities, and IBM officials provided an effective instructional program in EDP, the first of its type in this geographical area.

Section 8

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Title VIII, National Defense Education Act

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Provisions and Regulations, Title VIII, National Defense Education Act (NDEA)

Provisions

TITLE VIII of the National Defense Education Act of 1958, P.L. 864 (85th Congress), provides for the administration of Area Vocational Education programs. It amends the Vocational Education Act of 1946 (The George-Barden Act) by adding a new Title III to that act, providing for technical education programs for young people and adults.

The purpose of Title VIII is best expressed in Section 303 (a) (3) of the Title itself:

> . . . . . funds . . . shall be used exclusively for the training of individuals designed to fit them for useful employment as highly skilled technicians in recognized occupations requiring scientific knowledge as determined by the state board for such state, in fields necessary for the national defense.

To be eligible to participate in this program, a state must include in its state plan a part which: (1) designates the State Board for Vocational Education as the sole agency for administration of this part of the plan; (2) provides minimum qualifications for teachers, teacher-trainers, supervisors, directors, and others having responsibilities under the plan; (3) shows the plans, policies, and methods to be followed in carrying out this part of the state plan; (4) provides necessary accounting and budgeting procedures; and (5) provides that the state board will make periodic reports to the U.S. Commissioner of Education.

Funds are allotted to a state in an amount bearing the same ratio to the total sum appropriated for this program as the total amount alloted to the state under Title I of the George-Barden Act bears to the total sum appropriated for programs under that title.

Funds may be used for administration, supervision, salaries of teaching and supervisory personnel, instructional supplies and equipment, and certain other essential operating costs for the program.

Payments to states must be used exclusively for training individuals for useful employment as highly skilled technicians in fields necessary for the national defense.

Annual authorization: $15,000,000.

Appropriation: Fiscal year 1961—$9,000,000; fiscal year 1962—$12,800,000; fiscal year 1963—$14,000,000.

Basis: 50-50 matching by state and/or local funds.

Regulations

§ 102.101 *Area vocational education programs.*

The provisions of Title VIII, NDEA, are excerpted from the U.S. Office of Education publication, Report on the National Defense Education Act, Fiscal Years 1961 and 1962. *(OE-10004-62). The regulations for the administration of Title VIII are reprinted from the pamphlet* Area Vocational Education Programs *(OE-8001, Misc. No. 3560), 1962, 5-7.*

An area vocational education program operated under Title III of the George-Barden Act* is a program of vocational instruction, as defined in section 102.41, consisting of one or more less-than-college-grade† courses conducted under public supervision and control and on an organized, systematic class basis, which is made available to residents of the state or an area thereof designated and approved by the state board.

§ 102.102 *Categories.* Area vocational education programs operated under Title III are not considered to be under any of the separate categories of vocational education supported under the Smith-Hughes Act and Titles I and II of the George-Barden Act, i.e., agriculture, distributive occupations, home economics, trades and industries, and practical nursing.

§ 102.103 *Matching funds.* The act requires that there shall be spent for area vocational education programs under Title III an amount of state or local funds or both at least equal to the federal funds expended under such title. The state's financial report for the year must show the amount of state and local matching funds expended under the plan.

§ 102.104 *Special provisions regarding use of funds.* The total amount of state and local funds to be spent in any year for vocational education programs operated under the provisions of the Smith-Hughes Act and Titles I and II of the George-Barden Act may not be reduced below the amount of such funds expended under such programs and reported to the Commissioner for the fiscal year immediately preceding that in which the state first uses funds under Title III except that such reduction below the amount expended in such preceding fiscal year may be made as long as,

(a) in making such reduction, the amount of state and local funds used to match each of the several allotments under the Smith-Hughes Act and Titles I and II of the George-Barden Act is not reduced below the amount needed for dollar-for-dollar matching of each allotment, and

(b) an amount of state and local funds at least equal to the amount of the total reduction is to be expended under Title III.

§ 102.105 *General plan requirements under Title III.* To be eligible to participate under Title III there must be added to the state plan a new part, meeting the requirements of section 305(a) of the George-Barden Act, which sets forth the plans, policies, and methods to be followed in administering and operating area vocational education programs under Title III.

§ 102.106 *Approval of area vocational education programs.* The state plan is to set forth the standards and procedures which the state board will use in approving area vocational education programs. Such standards and procedures are to show how the following minimum criteria will be implemented.

(a) There is a need in the employment market for persons trained in the occupation for which training is provided.

(b) The content of the courses for which funds may be used has been determined by competent persons on the basis of an analysis of the occupation or cluster of occupations.

(c)(1) Those enrolled in the program have the necessary general educational background to benefit from the vocational instruction given in the program, and to fit them for the occupation for which the training is being given, or (2) such necessary general education, including scientific education, is available to those enrolled as part of their total curriculum.

(d) The program is of sufficient duration and there is sufficient time devoted to the technical courses in the curriculum to fit those enrolled for employment.

(e) Classrooms, shop, and laboratory facilities, including instructional equipment and supplies for effective instruction are to be available.

(f) Personnel with professional and technical preparation and experience are to be employed as instructors and supervisors.

(g) A system of student selection based on interests, aptitudes, previous education, and work experience is to be maintained.

(h) See 102.108(b).

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* EDITOR'S NOTE.—Title III of the George-Barden Act is the same as Title VIII of the National Defense Education Act (NDEA). Title VIII amended the George-Barden Act by the addition of Title III to provide for technical education for young people and adults.

† EDITOR'S NOTE.—"Less-than-college-grade" courses are generally interpreted to be courses in a program which is not designed to lead to a baccalaureate degree.

§ 102.107 *Geographic areas to be served.* To qualify under Title III a program must be made available to residents of the whole state or of "an area thereof designated and approved by the state board." The state plan is to set forth the policies and criteria to be used by the state board in determining that the geographic area served by a program is sufficiently extensive (e.g., with reference to such factors as population served, area served, etc.) to qualify the program as an "area vocational education program" under Title III.

§ 102.108 *Training programs.* Title III requires that funds "shall be used exclusively for the training of individuals designed to fit them for useful employment as highly skilled technicians in recognized occupations requiring scientific knowledge, as determined by the state board for such state, in fields necessary for the national defense." The state plan is to set forth the procedures and criteria to be used by the state board in determining which training programs meet this requirement.

(a) Kinds of courses. Within the foregoing requirements and procedures, funds may be used for the following kinds of courses concerned primarily with the application of technical knowledge and technical understanding in contrast with manipulative skill:

(1) Extension (supplementary) courses which are designed for employed persons, including journeymen, to obtain additional training in the direct application of specialized functional aspects of science, mathematics, and advanced technical skills and information required to meet the demands for highly skilled technicians in recognized occupations because of new and changing technologies. Such instruction may be organized to provide the required related instruction for apprentices.

(2) Preparatory (pre-employment) courses which are designed to prepare persons for useful employment to meet the demands for highly skilled technicians in recognized occupations (and not for training persons for a skilled trade) which requires the direct application of specialized functional aspects of science, mathematics, and advanced technical skills and information.

(b) Eligibility to enrol. Any person may be permitted to enrol who has either completed the ninth grade or, regardless of his school credits, is at least 16 years of age and can reasonably be expected to profit by the instruction offered.

§ 102.109 *Occupations necessary for the national defense.* Title III requires "that funds * * * shall be used exclusively * * * for the training of individuals as highly skilled technicians in recognized occupations * * * in fields necessary for the national defense." Both of the following criteria are to be used to determine occupations that are considered necessary for the national defense:

(a) The occupation will have a significant number employed, or an over-all shortage exists or is developing:

(1) In the design, development, testing, manufacture, processing, construction, installation, operation, maintenance, repair or servicing of plant facilities, equipment or products (or parts or accessories thereof) which are of importance for military or other defense activity.

(2) In providing technical services.

(b) The industry or activity in which the occupation occurs is necessary to the defense program, such as:

(1) The military.

(2) Suppliers of products or services to the military.

(3) Suppliers of products or services directly connected with defense.

(4) Scientific research.

§ 102.110 *Instructional equipment and supplies.* (a) Under Title III funds may be used for the purchase, rental or other acquisition, and maintenance and repair of instructional equipment and the purchase of instructional supplies and teaching aids.

(b) The state plan is to indicate how equipment and teaching aids will be accounted for. The plan is also to set forth the rules and policies to be used in the purchase and rental of equipment and supplies for area vocational education programs to assure proper expenditure and use in approved courses.

§ 102.111 *Transportation of students.* (a) Necessary costs of transportation of students include only (1) transportation for one round trip per semester or shorter period determined by the duration of the program from the student's home to the place where he will reside while enrolled in the program; (2) transportation for one round trip daily between a student's place of residence and the school; (3) transportation between schools in one of which the student is enrolled in a technical program; (4) transportation between the school and the establishment where work experience is provided; and, (5) transportation of classes for field work.

(b) Transportation may be provided by common carrier, school bus, or private conveyance. Costs may not be paid in excess of costs of transportation by common carrier, or, in the absence of suitable transportation by common carrier, in excess of reasonable rates established by the state.

§ 102.112 *Vocational guidance.* Costs of vocational guidance under Title III include only the costs of guidance services performed in area vocational education programs for the recruitment, selection, and retention of persons for training and the placement of persons trained in such programs, and the supervision of such guidance service. If funds are to be used for vocational guidance, that part of the plan in which area vocational education programs are described is to include a description of the plans and policies for the expenditure of funds for vocational guidance in such programs.

Section 9

Professional Organizations Concerned with Technician Education

The American Association of Junior Colleges

THE American Association of Junior Colleges was established at a meeting at St. Louis, Missouri, in 1920. George F. Zook, specialist in higher education at the United States Bureau of Education (as it was then called), gathered together 34 representatives from 22 of the 207 junior colleges existing at that time to define the junior college by creating standards and criterions, to determine its position structurally in relation to other parts of the school system, and to make a contribution to the work of education.

Today there are 704 junior and community colleges, 540 of which are members of the American Association of Junior Colleges. Junior colleges enrol 818,869 students, and both the number and enrolments of junior colleges are increasing at a fast pace. The AAJC constitution states: "The purpose of this organization shall be to stimulate the professional development of its members and to promote the growth of the junior colleges."

One of the ways that the American Association of Junior Colleges has made a genuine contribution to the work of education while promoting the growth of the junior college is in the area of technical education. Governmental and industrial leaders have repeatedly emphasized the growing and critical need for college-trained technician and semiprofessional personnel, and in many cases have pointed to junior colleges as a major resource for production of such personnel.

A significant effort in technical education development is represented by a national conference on technical education held in July of 1962, sponsored by the American Association of Junior Colleges. Conferees, representing junior colleges, government, and industry, recommended closer cooperation between industry and the colleges; stepped-up student recruitment; three-way communication among industry, universities, and junior colleges to insure proper preparation of teachers for technical education programs; and the development of high-school guidance programs that would recognize the technical education potential of junior colleges.

In May, 1963, the Association cooperated with the University of Michigan in a technician manpower conference sponsored by President Kennedy's Office of Emergency Planning. At the conference, the Association was again active in planning how the junior college can contribute to the supply of trained technicians by providing quality technician programs.

A bulletin, *Technical Education in the Junior College,* being written by Norman C. Harris, associate professor of technical education, Center for the Study of Higher Education, University of Michigan, is scheduled for publication by the AAJC this fall (1963) with financial assistance from the Alfred P. Sloan Foundation. It is hoped that the bulletin will make a significant contribution to technical education by giving direction for the creation of appropriate programs of technical education in junior colleges. In addition to the publication of the bulletin, the AAJC is engaged in a continuing study of the needs in technical education and is outlining an action plan for improvements in the field.

Headquarters of the AAJC is at 1785 Massachusetts Ave., N.W., Washington 6, D.C.

AMERICAN ASSOCIATION OF JUNIOR COLLEGES

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American Technical Education Association, Inc.

By William N. Fenninger

Executive Secretary

THE American Association of Technical High Schools and Institutes, the forerunner of the American Technical Education Association, Inc., was organized at Cass Technical High School in Detroit in December, 1928. Of the first three presidents, one was from Canada.

At the annual meeting in Miami, Florida, in December, 1950, in the interest of simplicity and to indicate its broader scope, the name of the Association was changed from the American Association of Technical High Schools and Institutes to the American Technical Education Association.

In 1960 the Regents of the University of the State of New York granted an absolute charter to the American Technical Education Association. The Association is incorporated as a nonprofit educational corporation. Dues are deductible in filing income taxes. The following is taken from the charter: "The purposes for which such corporation is formed are: (*a*) To promote technical education for interested and qualified youth and adults; (*b*) To recommend standards for technical education; and (*c*) To provide an opportunity for an exchange of ideas among persons in the technical education field."

Newsletters.—With the establishment of the new post of executive secretary, which was part of the constitution adopted in Philadelphia in 1957, the Association began the publication of a newsletter. The first of these was issued on June 19, 1958. These *Newsletters* are issued six times a year. They contain a digest of much of the current literature in the field of technical education, including new textbooks. They are designed to inform ATEA members of the most pertinent and significant events and developments in the field of technical education, both in schools and industry.

Services to Individual Members.—1. An international annual convention is held with outstanding speakers who discuss the problems of technical education and their solution. At least one of these speakers is always from Canada.

2. Copies of the ATEA convention addresses are sent to members.

3. The ATEA convention is held in the same city as, and just prior to, the American Vocational Association convention, so that one trip includes both conventions.

4. At least six significant and informative news-

letters are issued each year. These provide members with selected information which it is difficult, if not impossible, to obtain without membership.

5. From the great mass of literature on technical education, selected quality publications are sent to all members.

6. Members receive the annual report of the executive secretary and a certified financial statement of the Association.

7. Biennially, a membership directory is furnished to members.

8. The association provides consulting services on a wide variety of problems involved in establishing, expanding, and improving technical education.

Institutional Member Service.—Institutional memberships for schools offering technical courses are available to public and private technical institutes, community and junior colleges, technical high schools, and vocational-technical schools. Institutional members receive the services listed above. In addition, they receive selected professional publications which are too expensive to send to individual members or of which the supply is too limited. For example, institutional members were sent a copy of the American Society of Engineering Education report, *Characteristics of Excellence in Engineering Technology Education.* Institutional members also receive copies of ATEA committee reports. A recent one was a progress report of the joint American Technical Education Association—National Association of Industrial Teacher Educators Committee on "The Selection and Education of Teachers of Technical Subjects."

Industrial Member Service.—Industrial membership is open to those companies which employ technicians or are interested in increasing the supply of well-trained technicians, including companies which publish texts for the training of technicians or which make equipment for the training of technicians. Each company which takes out an industrial membership may appoint a representative who is eligible to serve on a School-Industry Coordinating Committee. This Committee gives help to the schools in determining the number of technicians that should be trained for each occupational area and also assists in keeping instruction up-to-date so that technicians of the number and quality needed by industry may be trained.

Plans for Extended Service.—At a meeting of the Trustees in June, 1963, it was decided to make a study similar to the one reported in the ASEE report, *Characteristics of Excellence in Engineering Technology Education,* but for the levels of technician education not included in the ASEE report. Preliminary plans are under way. Also a committee is at work in the preparation of a bibliography of textbooks suitable for technician education. Other committees are contemplated.

In order that a larger number of teachers may participate in the work of ATEA, more regional conferences are being planned. Two New England regional conferences and a western New York Conference have been held. In these conferences, teachers participate in panel discussions.

The American Technical Education Association, Inc., will play an increasing role in this field of education. It is the *one* organization which assists in the development of programs designed to increase the supply of well-trained technicians at all levels, whether the training is given in high school or post-high school, whether given in public schools or private institutions. It fosters cooperation among all agencies offering quality programs.

AMERICAN TECHNICAL EDUCATION ASSOCIATION, INC.

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Madison, Wisconsin

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Director, Evening Division
Lowell Technological Institute
Lowell, Massachusetts

Richard W. Howes, treasurer
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Delmar, New York

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Engineers' Council for Professional Development

THE Engineers' Council for Professional Development (ECPD) was founded in 1932 because of the need to improve engineering education and to encourage the development of a professional attitude among young engineers. This was to be accomplished through such activities as guidance, engineering schools, training, recognition, ethics, and information committees.

Participating bodies in the work of the ECPD are the American Institute of Chemical Engineers, American Institute of Electrical Engineers, American Institute of Mining, Metallurgical and Petroleum Engineers, American Society of Civil Engineers, American Society for Engineering Education, The American Society of Mechanical Engineers, The Engineering Institute of Canada, Institute of the Aerospace Sciences, The Institute of Radio Engineers, and the National Council of State Boards of Engineering Examiners.

Since its founding, the Council has expanded its operations, one phase being the education of engineering technicians. It has an active Subcommittee on Engineering Technology of its Education and Accreditation Committee.

Headquarters of the ECPD are at 345 East 47th St., New York 17, N. Y., and Elsie Murray is executive secretary.

ECPD Accreditation Program for Curriculums Leading to First Degrees in Engineering Technology

Organization and Objectives

In an effort to serve industry and the engineering profession generally by stimulating the development of a better balanced system of technical education, the Engineers' Council for Professional Development in 1944 appointed a Subcommittee on Technical Institutes within the Council's Education and Accreditation Committee. After several years of study, the subcommittee recommended and subsequently established a basis for accrediting programs of technical-institute type. Diversity, both of programs and of types of institutions that offer them, made it difficult but imperative to set some limit on the type of curriculums that would be considered. This was not done in an attempt to enforce unified standards which might tend to force these educational programs into stereotyped patterns. Instead, each curriculum is appraised in terms of quality and accredited in the light of its own purposes, content, and scope.

Instruction in the broad area of technical education that lies between professional engineering on one side and vocational education on the other is conducted by several types of institutions. Curriculums offered by schools in the following categories may be considered by the subcommittee: (1) technical institutes, endowed or publicly supported; (2) junior colleges offering terminal programs; (3) divisions of colleges and universities; (4) proprietary schools, operated by individuals or corporations.

Definition

Curriculums to be considered are technological in nature and lie in the post-high-school area. They differ in content and purpose from those of the vocational school on one hand and from those of the engineering college on the other. Curriculums in this field are offered by a variety of institutions and cover a considerable range as to duration and content of subject matter, but have in common the following purposes and characteristics:

1. The purpose is to prepare individuals for various technical positions or lines of activity encompassed within the field of engineering, but the scope of the programs is more limited than that required to prepare a person for a career as a professional engineer.
2. Programs of instruction are essentially technological in nature based on principles of science and include sufficient post-secondary-school mathematics to provide the tools to accomplish the technical objectives of the curriculums.
3. Emphasis is placed upon the use of rational processes in the principal fundamental portions of the curriculums that fulfill the stated objectives and purposes.
4. Programs of instruction are briefer, and usually more completely technical in content than professional curriculums, though they are concerned with the same general fields of industry and engineering. They normally lead to the appropriate Associate Degree. Graduates of such programs are commonly designated as Engineering Technicians.
5. Training for artisanship is not included within the scope of education of technical institute type.

General Policies

In view of the diversification of engineering technology curriculums, the types of institutions that offer them, and the undesirability of enforced uniformity, each program or curriculum falling within the boundaries stated below will be recognized in terms of its own purposes, scope, duration, and content. Published lists of such accredited programs, or curriculums, will indicate the name of the curriculum and the institution offering it.

Accredited curriculums shall satisfy the following requirements:

1. *Duration.* Not less than two academic years of full-time residence work beyond the secondary school or the equivalent in part-time work.
2. *Requirements for Admission.* High-school graduation or the equivalent. A high-school transcript indicating graduation or certification of equivalency must be available for all students.
3. *Curriculums.* Technological in nature, employing the application of physical science and the techniques of mathematics to the solution of practical problems, and comprising a prescribed sequence of related courses in a specific field, though not excluding a reasonable amount of elective subject matter.
4. *Instruction.* By accepted class and laboratory methods. Laboratory work shall comprise an important part of each curriculum.
5. *Teaching Staff.* Qualified as to educational training and experience and sufficient in numbers to provide adequate attention to each student.
6. *Educational Institution.* An organized school or a division of an institution devoted to the specific aim of providing technical institute programs; a stable organization having adequate financial support and demonstrated capacity and achievement in the engineering technology field.

   The school shall maintain a high standard of ethics in its educational program and in all of its dealings with students and prospective students. In its correspondence, published materials, and other public announcements, the statements used shall be frank and factual and shall not be misleading.
7. *Physical Facilities.* Adequate for the purposes of the curriculums offered.

Organization for Accrediting

The Subcommittee on Engineering Technology operates this accrediting program as a subcommittee of the Education and Accreditation Committee of Engineers' Council for Professional Development.

Accrediting Principles and Procedures

Accrediting is conducted in accordance with the following principles and procedures:

1. Individual curriculums are accredited. Separate examinations are conducted for curriculums offered in the evening or in geographically separated branches of an institution. In addition, cooperative programs are examined as independent curriculums.
2. Rigid standards as a basis for accrediting are avoided in order to prevent imposed uniformity and to encourage educational experimentation.

3. Curriculums are appraised on invitation of the institution offering them.

4. Curriculums are accredited on the basis of both qualitative and quantitative criterions which are evaluated through visits by a committee or committees representing Engineers' Council for Professional Development and through data secured from catalogs, other publications, and questionnaires.

5. Qualitative and quantitative criterions include the following:

- (*a*) Qualifications and experience of members of the faculty as well as the ratio of numbers of faculty to the numbers of students taught.
- (*b*) Standard and quality of instruction: (1) in technical courses, (2) in basic scientific and other required courses.
- (*c*) Scholastic work of students.
- (*d*) Records of graduates in industry.
- (*e*) Auspices, control, and organization of the institution and of its engineering technology division.
- (*f*) Curriculums offered and form of certificate or diploma offered.
- (*g*) Age of the institution and of the individual curriculums.
- (*h*) Basis of and requirements for admission of students.
- (*i*) Number of students enrolled: (1) in the institution as a whole and its technical institute division; (2) in the individual curriculums.
- (*j*) Graduation requirements.
- (*k*) Teaching staff and teaching loads.
- (*l*) Physical facilities devoted to technical institute curriculums.
- (*m*) Finances: investments, expenditures, sources of income.

6. Information supplied by the institution is for confidential use of Engineers' Council for Professional Development and will not be disclosed without the written authorization of the institution concerned.

7. Findings and recommendations of the visiting committee are reviewed in turn by a regional committee, by the Education and Accreditation Committee and the Subcommittee on Engineering Technology jointly and, finally, by Engineers' Council for Professional Development.

8. Published lists of curriculums include only those that have been accredited. No information is divulged as to curriculums which have been submitted for evaluation and not accredited or as to those which have not been submitted.

9. Published lists of accredited curriculums state the name of the institution and the name of the curriculum accredited.

10. Accreditation of a curriculum is granted for a limited period, usually from three to five years, with reappraisal stipulated at the end of the period. Accreditation is based on conditions as they exist at the time of evaluation and is granted only when conditions are considered as currently meeting minimum over-all requirements. If for any reason the future appears precarious, or definite weaknesses exist which should be strengthened, the accreditation will be granted for a shorter period (one to three years). Such precarious conditions include uncertainty as to financial status, uncertainty due to nature of administrative organization, need for additions to or improvements in staff or equipment, a new or changing curriculum, and undue dependence on a single individual.

11. The following statements are the only ones approved by ECPD for use in any public announcement when mention of accreditation is made:

> "An ECPD accredited Engineering Technology curriculum (program)"
>
> "An ECPD accredited Engineering Technician curriculum (program)"

If accreditation is withdrawn, the institution should no longer refer to the curriculum as accredited.

12. The Subcommittee on Engineering Technology will not recommend for accreditation as a curriculum of engineering technology type any curriculum for which the claim is made that it produces qualified engineers. No curriculum will be approved for accreditation or reaccreditation unless the word *technology* is used as the final noun in the title.

13. It is the province of the Subcommittee on Engineering Technology to recommend curriculums that lead to the Associate Degree.

Advisory Service

Incident to the accrediting program but only upon request of recognized officials of an institution, informal advice will be given on matters such as changes in educational policy, organization, curriculums, personnel, and physical facilities.

Reexamination and Review

In order to maintain the accredited list on a dependable and up-to-date basis, curriculums shall be reevaluated at intervals of from three to five years. This shall be by means of a visit by a committee or by means of information collected through questionnaires, or by both, as circumstances require.

National Council of Technical Schools

THE National Council of Technical Schools (NCTS) is a group of proprietary technical schools offering terminal courses that prepare graduates for immediate gainful employment in positions supplementary to those of professional engineering, according to its official statement. Graduates are designated as "engineering technicians" to distinguish them from medical technicians, textile technicians, etc.

The National Council of Technical Schools acts as an approval agency for proprietary schools offering courses in the semiprofessional engineering technical field. For a school to gain approval and admission, all conditions set forth in the Council's "Code of Minimum Standards of Practice for Technical Institutes" must be met.

The NCTS is comprised entirely of schools deriving their financial support from student tuition and/or endowments. Many member schools are chartered as nonprofit and none are supported from public tax funds.

The organization was formed in 1944 for the purpose of promoting sound educational, ethical, and business standards in the area of semiprofessional engineering education. A minimum of five years of continuous operation is required for admission to membership and every NCTS school must undergo reinspection of its courses each four years.

Headquarters are located at 1507 M Street, N.W., Washington 5, D. C.

Technical Institute Division and Technical Institute Council, American Society for Engineering Education

THE American Society for Engineering Education (ASEE) has had an interest in the technical institute type of higher education for over a quarter of a century. Beginning with committee activity in the field of technical institute education, increasing interest led to the organization of the Technical Institute Division of the ASEE and, more recently, to the establishment of the Technical Institute Council. The chairman of the Council is also a vice-president of the ASEE. The two groups cooperate in a number of activities.

The Technical Institute Division has committees functioning in the following areas: nominating, academic matters involving subject content, teaching methods and teacher development, the TID program at the annual ASEE meeting, and, with the ASEE board of directors, the James H. McGraw award committee.

The Technical Institute Council has activities in the following areas: manpower, nominating, program, relations with educational organizations, relations with government organizations, relations with high schools, relations with industry, relations with professional societies, teacher training, and advisory to the board for the certification of engineering technicians as sponsored by the National Society of Professional Engineers.

Among the activities carried on during the past year were a series of 19 events dealing with technical institute education at the annual meeting of the ASEE, a technical teachers exchange program with British teachers, close watch of state and federal legislative activity dealing with technical institute curriculum and facility development, development of a film strip with sound entitled *The Engineering Technician* with an accompanying pamphlet by the same name, a program for introducing high-school counselors to local industries, and development of a printed placement handbook in conjunction with Careers Inc. for distribution to potential employers of graduates of ECPD accredited curriculums and to local libraries.

TECHNICAL INSTITUTE COUNCIL, ASEE

Officers

Chairman: Karl O. Werwath, President, Milwaukee School of Engineering, Milwaukee 1, Wisconsin

Vice-Chairman: C. L. Foster, President, Central Technical Institute, Kansas City, Missouri

Secretary: Robert E. McCord, Director, Continuation Education in Engineering, Pennsylvania State University, University Park, Pennsylvania

Executive Committee: The above officers and H. P. Adams, Oklahoma State University, Stillwater; C. S. Jones, Academy of Aeronautics, LaGuardia Airport, Flushing 71, New York; W. D. Purvine, Oregon Technical Institute, Klamath Falls, Oregon; and A. R. Sims, University of Houston, Houston, Texas.

Section 10

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Certification of Engineering Technicians

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N. S. P. E. Sponsors Certification of Engineering Technicians

By Merritt A. Williamson, P. E.

Dean, College of Engineering, Pennsylvania State University, University Park, and Chairman, Board of Trustees, The Institute for the Certification of Engineering Technicians

IT has become more and more evident since the 1940's that accomplishments in the field of technology are the result of teamwork in which the engineer, the scientist, the technician, and the craftsman are brought together in a productive relationship. The popular press, however, has generally attributed the technological advances to the work of scientists. Engineers have been disturbed that they have not been acknowledged as important contributors. This has resulted in a real effort being made to educate the public on the true nature of engineering work. Since engineers do have societies and organizations, they have a way of achieving recognition.

The technician, however, has had no means by which he could receive proper recognition, and he has had no one to champion his cause. This has troubled a number of engineers who know what valuable contributions these persons make in the conduct of technical projects.

The National Society of Professional Engineers (N.S.P.E.), which is concerned with the professional aspects of engineering, has been dissatisfied that their teammates were forgotten men. In a foresighted moment a few years ago, the N.S.P.E. directed its president to appoint a committee "to concern itself with the relationship of the technician with the professional engineer; correspondingly, the relationship of the technician to the professional engineering society, and of the Society with respect to the technicians." The committee, after much deliberation, concluded that the engineer *does* have a concern with engineering technicians. As a means of recognizing this obligation, the committee recommended that the N.S.P.E. sponsor an Institute for the Certification of Engineering Technicians. This has been done. The Institute was established in 1960 and is now in operation.

The Institute

The Institute is an examining body only. It is not a society to which persons belong. It exists to perform the function of determining the competency of those who voluntarily apply for certification. Technicians who receive certification do not obtain membership in any grade within N.S.P.E. (which confines its membership entirely to Registered Professional Engineers). The Institute is governed by an unpaid Board of Trustees consisting of four professional engineers and four senior engineering technicians, the top grade recognized by the Institute. Its affairs are handled by an executive secretary, who operates under policies determined by the Board. The Institute does no instructional work. It is not in the education business.

The Institute does no evaluation of curriculums or institutions since this is being ably done by the Engineers' Council for Professional Development, with which a strong liaison has been established.

Certification Procedure

If a person wishes to become certified in one of the three grades (junior engineering technician, engineering technician, or senior engineering technician), he voluntarily submits an application form with a check for $10.00 and arranges for appropriate letters of endorsement from the requisite number of professional engineers or equivalents. In his application, in addition to all relevant personal information, he provides a detailed summary of his work assignments together with statements concerning the degree of responsibility for his work.

The Board then examines the documents. The table below sets forth the applicable criterions in abbreviated form. If the applicant meets the rigidly prescribed criterions for age, years of experience, education, etc., his experience record is examined to determine if it shows progressive advancement from job to job. The Board is determined that if any errors are made they will be in the direction of passing up a qualified person rather than lowering the standards.

If an applicant passes the review, he is then granted a certificate in the appropriate grade. He is charged an annual renewal fee of $2.00 to keep his certification current, and he may, when ready, apply for certification in the next higher grade for which there is a fee of $5.00.

The certified engineering technician may display his certificate, and he is issued a pocket card annually. Some engineers have felt that such a certificate might be confused with an engineering license, so in order to prevent any misunderstanding on the part of anyone, including the technician himself, there appears on the certificate the following statement: "This Certificate Does Not Constitute a License to Practice Engineering."

Benefits of Certification

The following are some of the benefits to be derived from this certification program:

1. The receipt of a certificate does provide some

Qualifications (condensed) for certification of engineering technicians.

Grade	*Age*	*Years of Experience to Get into Grade*	*Experience*	*Examination*
Junior Engineering Technician	No maximum or minimum	(a) 2 years or	Elementary technical ability. Endorsed by 1 Professional Engineer (or equivalent.)	None
		(b) graduate from an E.C.P.D. accredited program	None required No endorsement needed	None
Engineering Technician	No maximum 25 years minimum	7 years total	Demonstrates technical knowledge. Endorsed by 2 Professional Engineers (or equivalent.)	Exam equivalent to E.C.P.D. accredited 2 yr. level (may be waived at discretion of Board) or graduate from E.C.P.D. accredited school.
Senior Engineering Technician	No maximum 35 years minimum	17 years total	Demonstrates high qualifications. Knowledge of detailed technical character. Responsible performance. Endorsement of three Professional Engineers (or equivalent.)	None

means of recognition for the technician by adding status and prestige to the job of the engineering technician.

2. The progression which is possible through the various grades provides an incentive for further study on the part of the technician.

3. Certification should encourage more persons to become technicians.

4. Certification should result in better utilization of our total technological talent, including both engineers and technicians.

5. This should result in closer cooperation between engineers and technicians.

6. Certification should make possible a clearer differentiation between the professional work and obligations of the engineer, and the work which is appropriate to the engineering technician, which might be termed semiprofessional in character.

7. Certification should raise the level of technician competence, because of the opportunity for persons to plan their careers to advance from one level to another by seeking progressive experience.

8. Certification should also raise the level of the formal education of the technician.

9. Ultimately, technicians who hold certificates will probably wish to form their own society and develop some medium of communication concerned with the affairs of technicians.

10. It is hoped that suitable grades of membership for engineering technicians in the various engineering societies may be established and that certificates may become a criterion for such membership.

Current Status

The certification program has passed its organization stage and is now in full operation. The Institute is presently working out procedures to expedite the increasing load of applications. An Advisory Council, comprising representatives from the major engineering societies, is being organized to provide assistance.

The idea of certification has met with the approval of individual technicians and engineers, engineering societies, government agencies, and industrial organizations. In the opinion of those closely associated with its work, it promises to become one of the most important developments in the field of technology that has taken place thus far.

Further information and requests for applications should be directed to the Institute for the Certification of Engineering Technicians, 2029 K Street, N.W., Washington 6, D. C.

Section 11

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Forecast of Future Trends

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Forecast of Future Trends in Technician Education

By Lynn A. Emerson

Professor Emeritus, School of Industrial Relations, Cornell University, Ithaca, N.Y., and Consultant on Technical Education to the Federal and State Governments

WITHIN the past few years we have seen greatly increased interest in the development of technician education, coupled with considerable expansion of programs. What can we expect in the years immediately ahead?

The predictions which follow are based on the assumptions that population increase will continue along the same general pattern as in the 1950-60 period, that no major armed conflict will take place, that no major recession will occur, and that technological change will continue to accelerate. The predictions deal with the setting in which technician education takes place, with changes in industries and in the needs for technicians, and with the development and operation of programs for the training of technicians.

- Automation, new breakthroughs in science, and other technological change will continue to increase the types and numbers of technicians needed.
- The changing geography of American industry, continuing along the same general pattern as in the past decade, will expand the need for technicians in new areas of the nation. Rapid development of such needs may be expected in places where aerospace and similar federal government research facilities are being established.
- The numbers of technicians needed annually in industry by 1970, to fill new positions and as replacements for those who leave technician jobs, will probably reach an annual average of nearly 70,000 if the present ratio between technicians and engineers (approximately .7 to 1) is maintained. If the ratio *suggested as desirable* (two to one) is attained, the numbers needed annually will rise to some 200,000. It is doubtful whether this ratio will be reached, but some progress toward this goal may be expected.
- Although considerable expansion of technician training has taken place during the past five years, it is doubtful whether the nation will be able to meet the projected needs unless the rate of increase in training facilities is considerably accelerated. This will not take place unless substantial amounts of federal funds are made available and utilized for such training.
- A high proportion of new workers in technician occupations will need to come from organized pre-employment training programs in educational institutions. Many technicians will come from in-plant training programs, from the armed services, and through the upgrading of employed workers through evening courses, but the large bulk will need to come from youth who prepare themselves through pre-employment training programs.
- The age and grade levels at which pre-employment training is offered will continue to rise, with most of such training being provided through post-

high-school institutions. In the years immediately ahead, a considerable amount of technical education will be provided through high-school programs, partly due to the lack of sufficient post-high-school technical training facilities. As more post-high-school facilities are developed, the high-school training will probably take the form of basic pretechnical education, with specialization provided in the post-high-school institutions.

- Technician education will continue under a considerable variety of administrative patterns—private technical institutes, technical institute branches of engineering colleges, area vocational schools with technical curriculums, community colleges with such programs, and the like.
- Private technical institutes will continue their valuable contributions to technician training. The number of such institutions at present is not large and appears to be relatively stable. Some expansion of curriculum offerings will take place, especially in the newer fields of technology. Enrolments in private institutes will probably not increase as rapidly as in publicly supported institutions. There appears to be some tendency for private technical institutes to move toward three-year programs, and this may, in time, stimulate these institutions to a four-year program, resulting in the granting of bachelor's degrees in engineering or in industrial technology.
- Some expansion is taking place in technician training programs operated under the auspices of engineering colleges. In other places, consideration is being given to divorcing such programs from the parent institutions. No prediction is offered as to what the predominant trend will be.
- The area vocational-technical school, which offers skilled crafts training as well as technician training, will probably expand rapidly in the years immediately ahead, stimulated by federal funds earmarked for the construction and operation of such facilities.
- In the development and operation of technician training programs in area vocational-technical schools which are planned and administered by persons with backgrounds of experience in skilled crafts training, it is probable that in some instances the physical plant and the technical curriculums will be influenced by patterns of skilled crafts training that are not in line with the real needs in technician training. In time it may be expected that weaknesses of this type will be eliminated as administrators become more aware of technician training practices.
- Since area vocational-technical schools will be logical centers for training activity in skilled specialties under the Manpower Development and Training Act, there may be some difficulty in maintaining clear-cut programs of technician training, with high standards of technical content and with desirable status, in the same institution that operates the shorter, less-technical programs. This difficulty will be overcome in institutions that have administrative leadership that is aware of this problem and deals effectively with it.
- The trend toward the development of technician training in community colleges will continue. In the long run, the community college appears to be the most promising type of institution to provide the numbers of technicians needed, in industrial as well as in other occupational fields. New comprehensive community colleges will develop through the addition of technician and other occupational training curriculums to junior colleges whose programs are now largely limited to college transfer curriculums, and through the addition of transfer curriculums to area vocational schools and technical institutes. Some two-year extension centers of universities will probably be detached from the parent institutions and become locally administered community colleges. The extent to which the community college will contribute to technician training will depend largely on how well the leaders of these institutions come to understand the problems and deal effectively with them.
- State and local occupational surveys will continue to be used for determining curricular offerings in technician training programs. State employment security commissions will continue their service in occupational needs surveys, in cooperation with educational authorities.
- Increasing consideration will be given to the development of statewide master plans for technical education. New programs thereby will fit into the statewide pattern without undue overlapping of facilities, and will fill unmet needs with respect to curricular offerings and to geographical distribution.
- The range of curricular offerings in technician training programs will be widened. The development of additional programs in electronics will continue, with some slowing down if aerospace activities are curtailed. When compared with employment needs

in other technical fields, electronics programs will continue to be overemphasized. Many new programs in data processing for business and for engineering will be initiated. Instrumentation technology and production technology will expand as the needs in these fields are more fully recognized. Increasing attention will be given to curriculums for the training of technicians in fields outside of industry, such as the medical and health fields, business, and agriculture. More attention probably will be given to the development of programs of one year or less in length for the training of technical specialists. Curriculums that cut across the major occupational categories—such as technical sales, technical secretarial work, agri-business, and the like—will probably receive increased attention.

- There will be some trend toward more standardization of technical curriculums that prepare for occupations of national scope, and more effort will be put forth on the national level toward this end. Individual schools, however, will continue to resist acceptance of curriculums developed outside their own institutions. Some adaptation of nationally standardized curriculums will usually be necessary to fit them to local conditions, but much unnecessary effort will be exerted in local curriculum development.

- Pre-employment training programs will probably increase in number. These programs will permit attendance for some 15 hours per week, with students carrying on part-time employment, extending over a period of four years to complete the normal two-year full-time curriculum.

- Qualified teachers of technical subjects will continue to be in short supply; so will supervisors and administrators at local, state, and national levels. Strenuous efforts will be needed to overcome the shortages.

- Technical teacher-training programs will be developed in sections of the nation not now served by such programs. They will be offered in institutions with technical institute divisions, as well as engineering colleges, combining technical institute instruction with appropriate engineering and professional education subjects. They will lead to the bachelor's degree. Summer workshops for the upgrading of technical teachers will continue to be offered. Evening courses in professional technical education subjects will be developed in urban centers for employed technicians who desire to prepare themselves for full-time teaching positions. Many employed engineers and technicians will be utilized on a part-time basis for teaching in technician training programs.

- Women will be enrolled in increasing numbers in certain types of technician training programs. In time, considerable numbers of women will become teachers in such programs.

- Costs of technician training will continue to rise, both for capital outlay and for operating expense. This will be due, in part, to the increasing complexity of equipment and to the salaries needed to attract competent personnel for teaching, supervisory, and administrative positions.

- Recruiting of competent students for full-time technician training programs will continue to be a major problem. The lack of understanding of technician education on the part of high-school counselors, and their tendencies to guide all qualified students toward college engineering and science programs, will contribute to this problem. Strenuous efforts will be needed to develop in high-school counselors a true perspective toward the requirements and rewards of technician occupations. Special summer institutes for counselors will probably be utilized for this purpose.

- Accreditation of curriculums for training engineering technicians by the Engineers' Council for Professional Development will probably expand at a slow pace. Other forms of accreditation, by state and regional agencies, will probably provide most of the accreditation of programs for training other than engineering technicians.

- The credential granted to graduates of two-year post-high-school programs will increasingly take the form of the associate degree. Certificates will continue to be awarded for completion of shorter programs.

- Certification of engineering technicians, as developed by the Institute for the Certification of Engineering Technicians (sponsored by the National Society of Professional Engineers), will probably expand. It may be that similar certification will be developed for other technical workers.

- Changes in federal legislation concerning technician education will clarify regulations to indicate clearly that such education on the post-high-school level, subsidized by federal funds, is not restricted to programs of "less than college grade." As a result, credit toward a baccalaureate degree for courses taken as a part of a bona-fide technician training curriculum may be given by an institution which accepts the technician program graduate for further study, if the institution so desires.

- Research in technical education has not kept pace with the needs, and there is little promise at present for the development of such research on the scale required to meet the needs. Because of this lack of research, programs in technician education will not attain their maximum potential effectiveness.
- The many types of agencies concerned with technician education will continue their promotional efforts in somewhat diverse directions. This struggle for jurisdiction may continue for some time. Some steps, however, will be taken to get the various agencies to work more closely together, with mutual understanding of the part each may play in the total program.

Despite the many difficulties faced, the future of technician education in the nation looks bright. The increased public recognition of the need for technicians if the economy is to expand, and the awareness by educators of the tasks involved in technician education, will work together toward the development of the programs needed. A review of the situation 10 years from now may well show a much more promising picture.

Section 12

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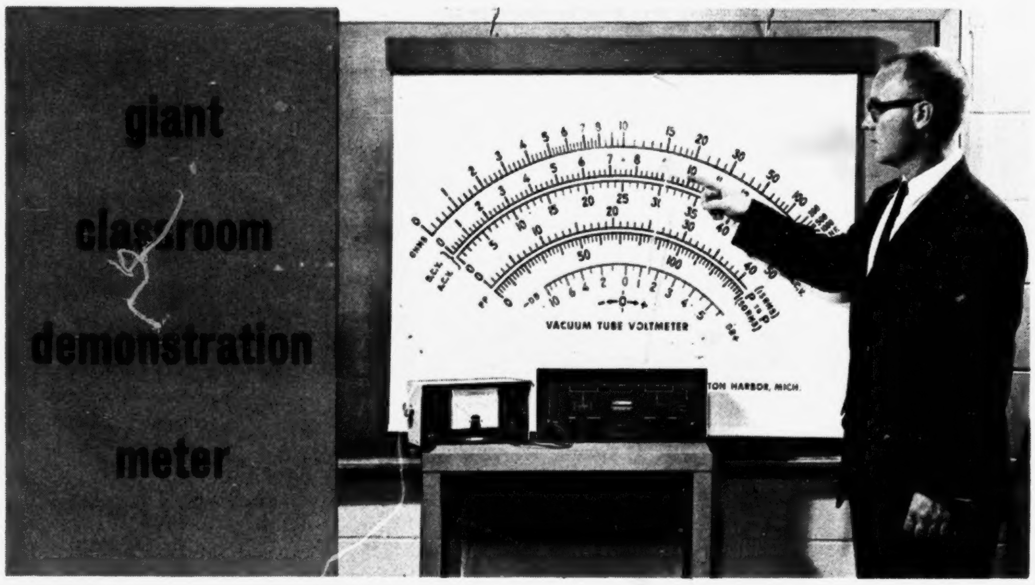

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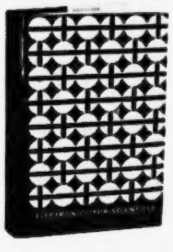

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